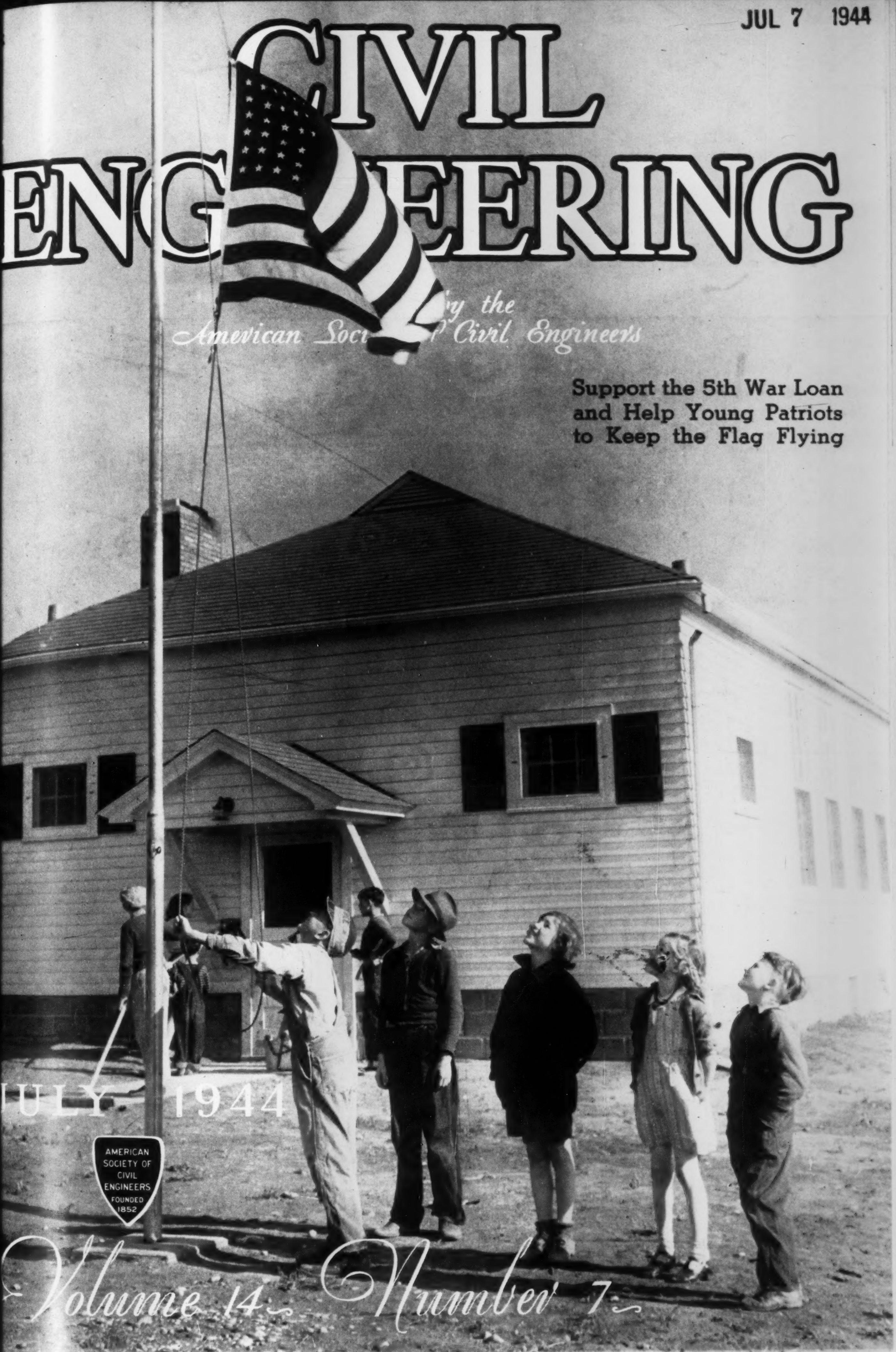
JUL 7 1944

CIVIL ENG EERING

y the
American Soci Civil Engineers



Support the 5th War Loan and Help Young Patriots to Keep the Flag Flying

JULY 1944

AMERICAN
SOCIETY OF
CIVIL
ENGINEERS
FOUNDED
1852

Volume 14 Number 7

PLAN NOW...

....FOR THE LANDS TO BE RECLAIMED TOMORROW

New plants and new industries will play a vital part in the post-war development of American cities. Many urban communities which have utilized all the high ground where the soil is firm will extend industrial operations to low ground, swamp, and marsh lands.

In the past many low lands have been drained and filled to the desirable level—and large structures have been built on Raymond Concrete Piles. Other similar projects are now being planned for the future.

With 47 years of world-wide experience, the Raymond organization stands ready to help you with firm foundations for the reclaimed lands of tomorrow. Let's get our heads together now. It's the only way to have plenty of jobs ready for our boys when they come marching home.

RAYMOND
CONCRETE PILE COMPANY
Branch Offices in Principal Cities
140 CEDAR STREET • NEW YORK 6, N. Y.

SCOPE OF RAYMOND'S ACTIVITIES includes every recognized type of pile foundation – concrete, composite, precast, steel, pipe and wood. Also caissons, construction involving shore protection, ship building facilities, harbor and river improvements and borings for soil investigation.

Among Our Writers

WILLIAM N. CAREY (U. of Minn. '13) saw service in France in 1918–1919 as a major of Engineers. After a period in consulting work, he became asst. city engr., later city engr., of St. Paul. In 1933 he headed the PWA office in Minnesota. Colonel Carey is now in the Corps of Engineers as Chief Engineer, Federal Works Agency.

GLENN E. HANDS (Kansas U., San. Eng. degree, '34) had early experience as assistant bacteriologist of the Kansas Board of Health, and water and light superintendent at Marion, Kans. In 1936 he entered the employ of Burns and McDonnell Eng. Co., and served on water works enlargements at Cincinnati, Little Rock, Knoxville, and Tampa, specializing in water distribution systems. He is now a lieutenant in the Sanitary Corps.

PHILIP SPORN (Columbia U.) has been with the American Gas and Electric Service Corp. since 1920—as Chief Electrical Engr. in 1927, as Chief Engr. in 1932, and as Vice-President and Chief Engr. since 1934, in charge of all technical operations. He has been in charge of the design and construction of numerous steam-electric and hydroelectric stations involving over 1,000,000 kw of capacity.

H. A. KAMMER (Pratt Inst., Brooklyn; Brooklyn Poly. Inst.) has been with the American Gas and Electric Service Corp. since 1924, first as design engineer in charge of electrical, structural, and mechanical design relating to power plants, and for the last 5 years as construction engineer. He was previously with the New York Edison Co.

J. L. BERGGREN has been with the Pacific Telephone and Telegraph Company for the past 30 years, primarily on engineering work in connection with construction and maintenance of long-distance plant. This involves open wire lines; aerial, underground, and buried long-distance cables; and underground conduit systems.

HOWARD P. MAXTON has engaged in general and heavy construction and related engineering for the past 20 years. Formerly secretary-treasurer of the Whitmire Construction Company of Kansas City, he was later on the construction of Madden Dam in the Canal Zone, then joined the TVA as General Cost Engineer. In 1940 he went with the Navy's Bureau of Yards and Docks to head up certain cost control work for cost-plus-a-fixed-fee contracts.

MCNEELY DUBOSE (U. of S.C., N.C. State College) has been associated with hydroelectric construction and operation in Central America, Europe, the United States, and Canada. For many years connected with aluminum production, he is now Vice-President of the Aluminum Company of Canada, Ltd.

A. L. ALIN designed and supervised construction of 2 multiple-arch dams above the Arctic Circle before coming to the U.S. from Sweden in 1923. Since 1934, he has been with the Army Engineers. He headed the Engineering Div. in Denison, Tex., during planning and design of Denison Dam and hydro plant. He is now investigating dam sites on the Missouri River.

VOLUME 14 NUMBER 7

July 1944

COPYRIGHT, 1944, BY THE
AMERICAN SOCIETY OF CIVIL ENGINEERS
Printed in U. S. A.

Entered as second-class matter September 23, 1930 at the Post Office at Easton, Pa., under the Act of August 24, 1912, and accepted for mailing at special rate of postage provided for in Section 1102, Act of October 3, 1917, authorized on July 5, 1918.

CIVIL ENGINEERING

Published Monthly by the
AMERICAN SOCIETY OF CIVIL ENGINEERS
(Founded November 5, 1852)
PUBLICATION OFFICE: 20TH AND NORTHAMPTON STREETS, EASTON, PA.
EDITORIAL AND ADVERTISING DEPARTMENTS:
33 WEST 39TH STREET, NEW YORK 18

This Issue Contains

COVER—Patriotic. *(Photo Courtesy Federal Works Agency)*

WAR JOBS AND THEN WHAT? 277
William N. Carey

TAMPA CURES ITS WATER DISTRIBUTION ILLS 281
Glenn E. Hands

REPAIRS TO BUCK POWER HOUSE AND DAM 285
Philip Sporn and H. A. Kammer

AERIAL PHOTOS MAP ROUTE FOR TRANSCONTINENTAL TELEPHONE CABLES 287
J. L. Berggren

COST-PLUS-A-FIXED-FEE CONTRACTS OF THE NAVY BUREAU OF YARDS AND DOCKS 289
Howard P. Maxton

THE SHIPSHAW HYDROELECTRIC PROJECT, CANADA. I. History of Saguenay River Power 293
McNeely DuBose

PENSTOCK SURGE TANK AT DENISON HYDRO PLANT 296
A. L. Alin

ENGINEERS' NOTEBOOK

Servicing of Wartime Timber Structures 299
Chester J. Hogue

Winding and Welding Steel Cages for Reinforcement of Concrete Pipe 301
William A. Shelton

OUR READERS SAY 302

PROGRAM OF SOCIETY'S SEVENTY-FOURTH ANNUAL CONVENTION . 305

SOCIETY AFFAIRS 311

ITEMS OF INTEREST 319

NEWS OF ENGINEERS 321

DECEASED 321

CHANGES IN MEMBERSHIP GRADES 14

APPLICATIONS FOR ADMISSION AND TRANSFER 18

ENGINEERING SOCIETIES' PERSONNEL SERVICE 24

RECENT BOOKS 24

CURRENT PERIODICAL LITERATURE 26, 28, 30

EQUIPMENT, MATERIALS AND METHODS . . 32, 34, 36, 37, 38, 40, 41

INDEX TO ADVERTISERS 46

The Society is not responsible for any statements made or opinions expressed in its publications.

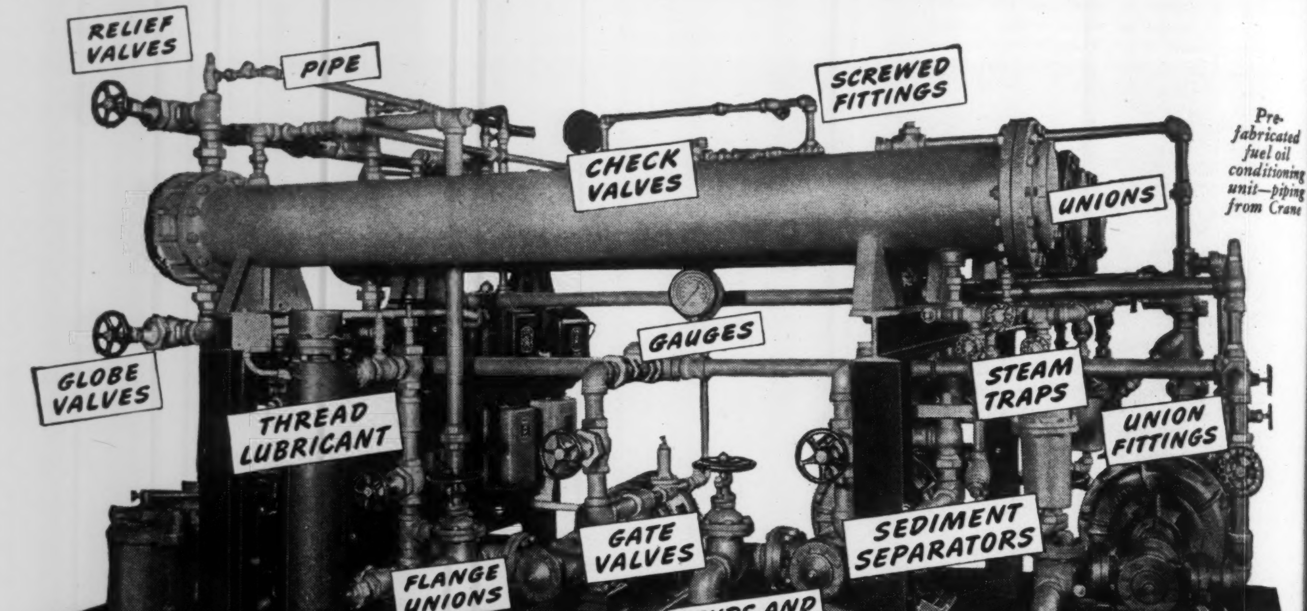
Reprints from this publication may be made on condition that full credit be given CIVIL ENGINEERING *and the author, and that date of publication be stated.*

SUBSCRIPTION RATES

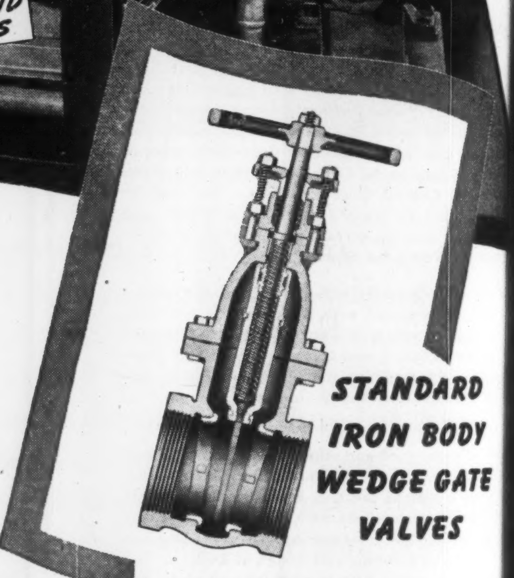
Price 50 cents a copy; $5.00 a year in advance; $4.00 a year to members and to libraries; and $2.50 a year to members of Student Chapters. Canadian postage 75 cents and foreign postage $1.50 additional.

Member Audit Bureau of Circulations

Complete systems or single fittings . . . Crane meets every piping nee


RELIEF VALVES
PIPE
SCREWED FITTINGS
CHECK VALVES
UNIONS
GAUGES
GLOBE VALVES
THREAD LUBRICANT
STEAM TRAPS
UNION FITTINGS
GATE VALVES
SEDIMENT SEPARATORS
FLANGE UNIONS
STUDS AND GASKETS

Pre-fabricated fuel oil conditioning unit—piping from Crane



STANDARD IRON BODY WEDGE GATE VALVES

One Source of Supply . . . One Responsibility for Materials

In buying day-to-day piping needs—or when you're planning complete new systems—the benefits of single source supply can be yours. Crane supplies everything for piping—valves, fittings, pipe, and all accessories—as indicated by the installation above. And where can you expect more complete selection than in the world's largest line of flow-control equipment for every service.

Ordering—handling parts stocks—maintenance—all these operations are simplified when you Crane equip. More important, one responsibility for quality and craftsmanship of piping materials is a primary aid to good installation. Crane meets that responsibility with 89 years of manufacturing experience.

CRANE CO., 836 S. Michigan Ave., Chicago, Ill.

One Standard of Quality . . .

Because there is adequate quality in every part, the whole system is thoroughly dependable when it's Crane equipped. Such quality is typified by Crane Iron Body Gate Valve design: Strong body sections resist severest line strains. Straight-through ports give streamline flow. A deeper stuffing box lengthens packing life. Extra long guides keep disc travel true, while balanced stem design maintains smooth and positive operation.

CRANE

VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS

MALCOLM PIRNIE
President
GEORGE T. SEABURY
Secretary
SYDNEY WILMOT
Editor in Chief and Manager of Publications
DON P. REYNOLDS
Assistant Editor

CIVIL ENGINEERING

COMMITTEE ON PUBLICATIONS
SCOTT B. LILLY
Chairman
N. W. DOUGHERTY
S. C. HOLLISTER
FRED C. SCOBEY
WILBUR M. WILSON
W. L. GLENZING
Advertising Manager

VOLUME 14 JULY 1944 NUMBER 7

War Jobs and Then What?

Urging a Program of Public Works to Absorb Postwar Unemployed

By WILLIAM N. CAREY, M. AM. SOC. C.E.

COLONEL, CORPS OF ENGINEERS; CHIEF ENGINEER, FEDERAL WORKS AGENCY, WASHINGTON, D.C.

NO one believes for a moment that the development of a big construction program will solve all the problems of postwar economy. At the same time the uncertainty that private business and industry will be able to provide jobs at the war's end indicates the need for a field of opportunity flexible enough to put men to work at useful tasks when they are available. Such a field, says Colonel Carey, will be provided when $160,000,000 worth of plans and specifications for four billion dollars worth of public works have been prepared. This paper is condensed from recent addresses presented before the St. Louis and Metropolitan Sections of the Society.

"WAR jobs and then what?" The answer, of course, is peacetime jobs. That leaves unanswered the questions of How? How many? When? Where?

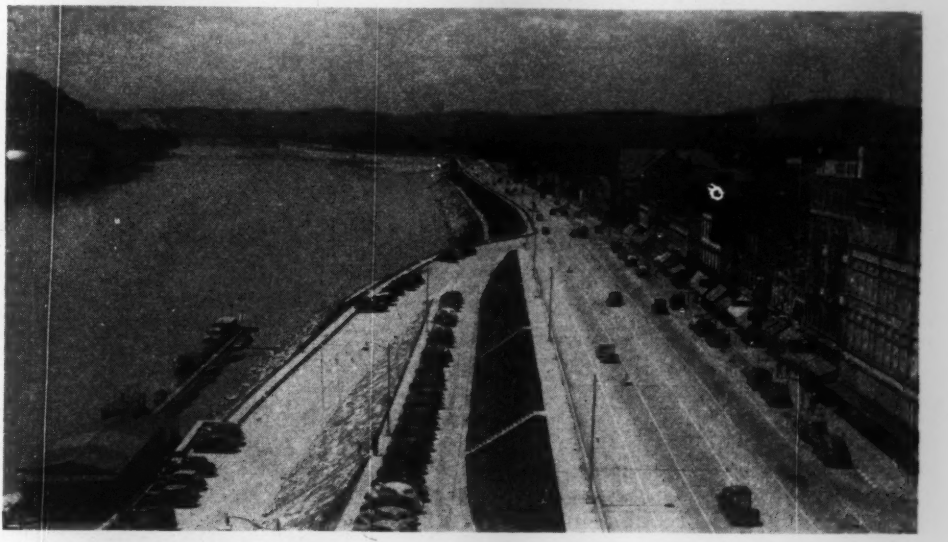
The solution is as complicated as the problem is big. There is lack of agreement as to the type of action that should be taken. There are even some who see no need for any special provision now. Our immediate national objective is the winning of the war. That alone is a big enough job to tax to the limit our best military and political minds. Winning the war—what to do and how to do it—is far less complicated than the bigger problem of winning the peace. There are fewer unknowns and indeterminates in it. But on the war front, at least, the people generally are willing to leave the job to trained experts.

When it comes to creating a design for peace, however, nearly every one of us considers himself qualified to speak as an expert. And speak we do, at length and often. Ideas without number, looking toward the evolution of postwar prosperity and jobs for all, get a daily workout throughout the land, from ponderous debates in the halls of Congress to the discussions of the earnest ladies of the Whiffletree County Ladies Aid Society. Instead of disparaging or poking fun at this lively public interest, we should be grateful for it. This is democracy in action, and the more ideas, the better.

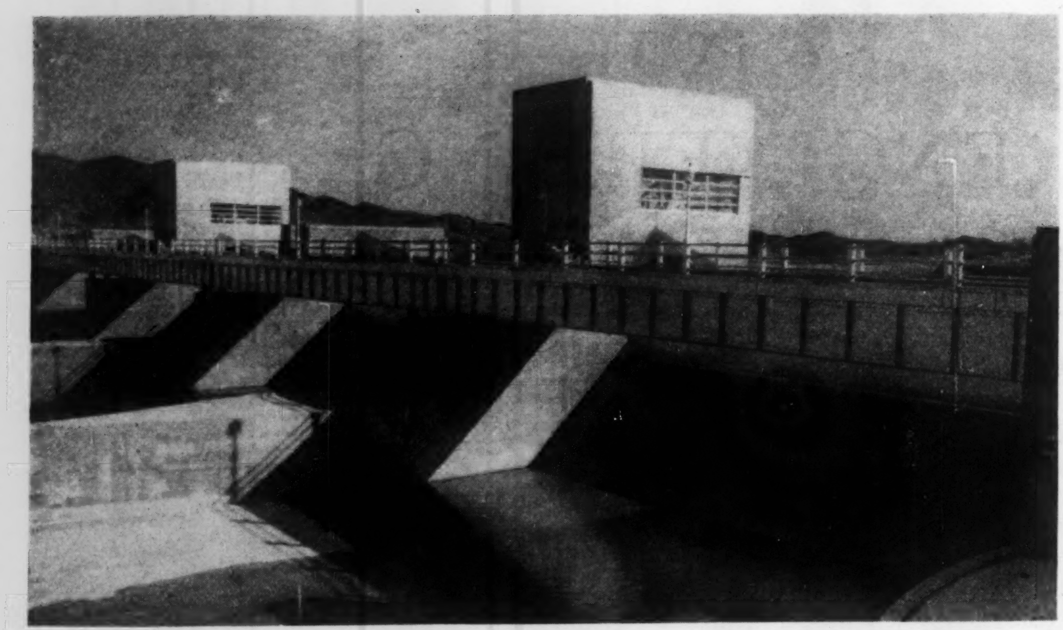
One assumption we can make with certainty. It is that the vast majority of our thinking citizens agree that we must take steps now to assure a postwar economic structure under which the greatest possible number of jobs can be incubated. Perhaps it is natural that there should be greater unanimity of thought as to the shape and size of our postwar job problem than as to its solution.

National prosperity depends upon national income, which in turn depends on jobs and production. Experience has shown that with an annual national income of around 90 billion dollars, we had reasonably full employment and fair prosperity. That was true when our national debt was under 40 billion. With a national debt in the neighborhood of 300 billion after the war, we will require a greater annual income than ever before if we are to maintain our living standards and begin to bring the debt back to manageable proportions. Though economists are by no means in agreement, the majority opinon is that a national annual income of between 130 and 140 billions is necessary to guarantee a fully prosperous postwar era.

Similar opinion indicates that postwar prosperity can be attained through the employment of from 56 to 60



FEDERAL FUNDS HAVE BEEN APPROPRIATED FOR POSTWAR HIGHWAY PLANS
Kanawha River Boulevard, Charleston, W.Va.



DEVELOPMENT OF WATER RESOURCES CAN BE UNDERTAKEN WHEN FUNDS AND MEN ARE AVAILABLE
Imperial Diversion Dam, Imperial Valley, Calif.

million people. This means a substantial increase over the employment figures of 1940. That was by no means a depression year, yet Matthew Woll, chairman of the A. F. of L.'s Postwar Planning Committee, recently asserted before a Senate committee that we had about 9 million unemployed workers in 1940. He expressed the fear that, if we hold to 1940 production standards for the immediate postwar period, there will be 19 million unemployed. Of course, that is the fear of but one well-informed man who, perhaps, could be accused of bias. It does, however, support the view that if we are to enjoy after the war the standard of living for which we now fight, we must employ more people; and produce, consume, and sell more things than ever before in our history. The 1940 level of economic activity will not be good enough. It is estimated that the productivity of labor has increased by about 10% in the last four years, which means that today we could produce the 1940 volume of goods and services with about 4 million fewer workers employed. Present military plans show a probable figure of between 10 and 11 million Americans under arms when the war reaches full fury. The number of our people exclusively employed in war industry has not been determined. Good estimates run from 7 to 10 million men and women. On the basis of these estimates, the possible maximum unemployment stress on our postwar job incubator under design would be 20 million.

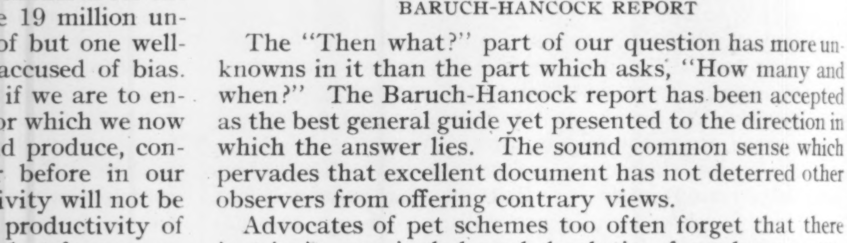
In other words, the employment opportunities of 20 million Americans would be directly affected to some degree were the war on all fronts to end at 11:00 a.m. tomorrow. As to actual jobs required, that formidable figure would be reduced materially by the number retained in the armed forces plus those engaged directly in industrial conversion. Some women now working in war plants and some older persons may be expected to leave the labor force, and some younger persons will return to school or college. Further modification would follow, depending on the rate of return of the demobilized millions. Another modifying factor, also indeterminate in amount, would apply if, as seems probable, the war in Europe is won before that in the Pacific.

Little reflection is needed to show the impossibility of arriving now at a reliable estimate of the number of job openings needed to provide useful work for demobilized military personnel and discharged war workers. Our design accordingly must keep flexibility as its main characteristic. Engineering reasoning dictates that we use the known elements of our problem—required national income and the total number of workers to produce it—as the basis for a program which will be elastic and resilient enough to meet these now indeterminate loads, whatever they may be and whenever they may be applied.

BARUCH-HANCOCK REPORT

The "Then what?" part of our question has more unknowns in it than the part which asks, "How many and when?" The Baruch-Hancock report has been accepted as the best general guide yet presented to the direction in which the answer lies. The sound common sense which pervades that excellent document has not deterred other observers from offering contrary views.

Advocates of pet schemes too often forget that there just isn't any single-barreled solution for a happy postwar national economy. It is much more complex than that. Among the many factors of importance are the equitable liquidation of war contracts, conversion of war



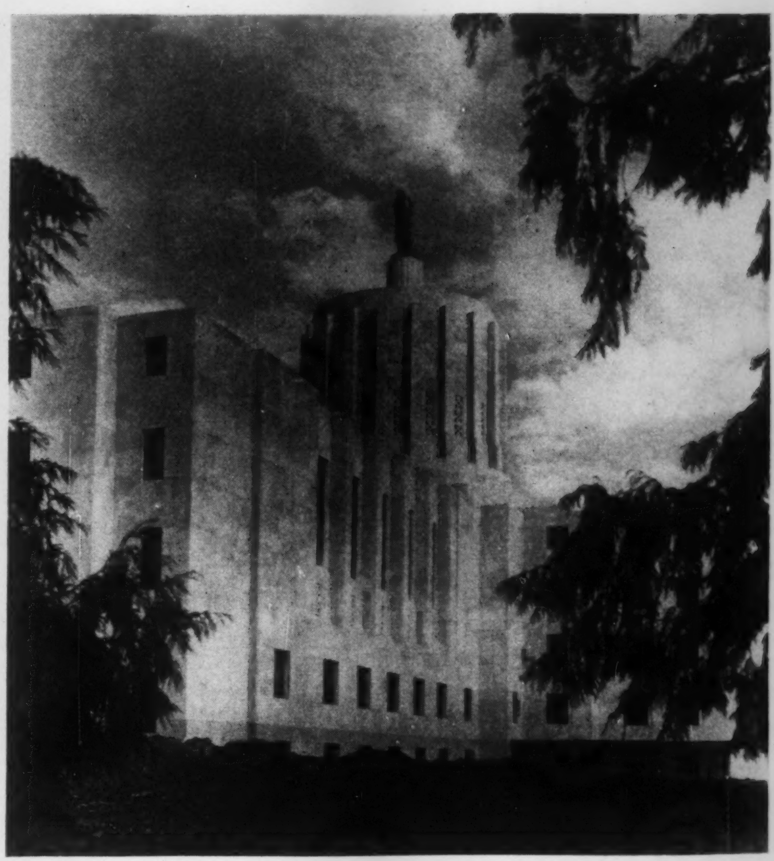
MANY COMMUNITIES LACK ONLY PRIORITIES TO EXPAND THEIR SANITARY WORKS
Sewage Disposal Plant, St. Paul, Minn.

plants to peace use, new private construction, a reservoir of needed public works, adaptation of war materials to the uses of peace, industrial and academic schooling for returned service men, readjustment of wartime population concentrations, creation of new and better foreign economic relations, and last but not least, the development of an adequate and equitable tax structure. All these are factors in the creation of postwar jobs, and each is related in some way to all the others. Intelligent overall planning must take all of them into consideration and work them out together.

All these factors successfully applied would doubtless result in our reaching the general objective outlined in the Baruch report, namely, a renaissance of private business and industry.

PUBLIC WORKS CAN BE CONTROLLED

But what if private business is slow to awaken to its new opportunities when peace comes, either suddenly or by stages? What of those essential jobs, if industry cannot or does not convert from war to peace quickly enough? That field of opportunity and jobs lies in the construction of useful public works. It provides the one large job pool in American industry which can be readily and accurately controlled in the public interest. If, before the war ends, we show the industry and foresight to fill a vast reservoir with mature plans for needed public works, we shall have the one certain and best insurance against future mass unemployment. The reservoir should be filled with plans and construction contracts ready to let in volume equal to three or four times the normal annual rate.



Construction of Many Public Buildings Has Been Postponed Until After the War

Oregon State Capital, Salem, Ore.

In spite of almost unanimous agreement that all local subdivisions of government should be diligently at work now on working plans for public construction, little actual progress has been made. The general inertia is most surprising. Local trains to carry blueprints for postwar construction and jobs are ready to roll in every community, but each seems to be waiting for some outside source to coal the locomotives. The possibility that the Federal Government will provide funds for local planning, and perhaps construction, is holding back action by local subdivisions of government. Many of these now are able financially to buy their own coal and pay their own way, but it is exceedingly doubtful if enough cities can or will plan a program of sufficient size to be a really important factor in the postwar readjustment without assistance.

WHAT CONGRESS IS LIKELY TO DO

Of course it is important that Congress should declare itself as soon as possible on this whole question. We have good reason to expect such a declaration soon, as Congress is devoting much attention to this and related matters. Some form of federal monetary assistance to awaken planning incentive and provide for central control probably will be forthcoming. No registered rider of the Washington merry-go-round expects Congress to say now whether or not there will be federal assistance for construction of local postwar works. That problem can be met when the end of the war is in sight and a better estimate can be made of the weight of public works then required to help keep the national economy in balance. People around Washington qualified to guess what Congress is likely to do believe that some form of federal loan soon will be made available as incentive and assistance to municipalities for planning only.

In any public construction program, the building of highways plays an important part. Also it is one type of construction acknowledged by all to be in part a federal responsibility. The long-established practice of matching state with federal funds on the approved federal road network is an accepted pattern of financing. It has been followed by Congress in making available to the states, on the customary 50–50 matching basis, the sum of 60 million dollars for making surveys, plans, and specifications for future construction. Most of our states have started on their planning work with their share of this appropriation and some states already have made creditable progress. However, many millions of these available federal funds for state highway planning still lie dormant in the government till.

Present possible, perhaps probable, legislation is said to provide authorization for a federal appropriation of one billion dollars a year for the first three postwar years for inter-regional highway construction. The plan generally favored for matching federal with state funds is, for the first year, 75% federal and 25% local; for the second year, a 60–40 ratio; and then back to the old 50–50 basis for the third year and thereafter. The inter-regional highway program, added to routine highway construction needs, sets up about a $2^1/_2$ billion-dollar road program for the first postwar year. Of this, about \$1,700,000,000 is for new construction and about \$850,000,000 for deferred maintenance.

These are impressive figures but most of us have little realization of what they mean. During the last ten years engineers have become accustomed to talk in millions and

WATER SYSTEMS OF PROGRESSIVE TYPE ARE BEING PLANNED FOR IMMEDIATE CONSTRUCTION AT WAR'S END

Central Water Plant, El Paso, Tex.

billions of dollars. These figures are so completely out of scale as compared to the few dollar bills most of us have in our pockets that we sense little relationship between them. We all can get a better mental grasp on what planning for this postwar public works program means, both for highways and for general public works, if we scale these huge total figures down to something we understand. This also will help toward a clearer concept of the amount of planning work, in all its detail, needed to produce contract documents complete and ready for letting during the first postwar year alone.

DOLLAR VALUE OF PUBLIC WORKS

A fair guess at the total amount of public works of all kinds needing to be done during the first postwar year lies between 4 and 6 billion dollars. To be ultra conservative, let us say 4 billion. This means that at least 4 billion dollars worth of construction must be put into working drawings and contract documents ready to go in the first year after Germany and Japan hoist the white flag of surrender. To translate this 4-billion figure into something we can understand, both in dollars and in work, let us see what that total means against a 4% average engineering fee to produce the plans only. That pretty figure is 160 million dollars. If 30% of that sum represents materials and non-labor items, plans for our first year's public construction involve an engineering payroll to the amount of 112 millions. This, remember, is just for engineering and architectural labor for plans for our first year's public construction. There isn't an engineer who does not know well that we haven't even scratched the surface of the job of making 160 million dollars worth of public works plans. And the time left to do the job is running out fast.

Development of a large construction program will not solve all the problems of our postwar economy. In normal times construction only accounts for about 10% of our national income, and public construction for but a third of that. The whole national economy cannot be supported by the construction industry alone, and public construction alone cannot be expected to sustain for long the whole construction industry. The strategic value of a stored reserve of needed public works construction is far greater than can be measured by its dollar volume. Public works present the only large factor in our national income which lies outside the field of private business but which can be simply controlled directly toward keeping the whole economy in balance. Controlled public works can be the gyroscopic stabilizer on our industrial ship of state to help it take safely the rough seas of the postwar years.

The flexibility possible in a public works program, and the ease with which it can be centrally controlled, make this the ideal force to absorb the early, small spirals of unemployment wherever they may form. If we are ready to check with public works jobs these early isolated spirals as and where they form, we will prevent their growing and joining into a single, spinning economic cyclone. Like the stitch in time, it is the job in time that saves nine. These economic spirals always have small beginnings. They grow and swell as readily upward as downward, and the important thing is to have the power to deflect them upward. A well-filled reservoir of ready, needed public works plans, subject to national control as to when and where, will provide the power to deflect unemployment spirals upward.

ROLE OF PUBLIC WORKS AS A STABILIZER TO COMPLEMENT PRIVATE INDUSIRY

If, after the war, business miracles happen, we need not and should not tap our reservoir for more than the volume of public works required as a stabilizer. The draft we make on our reservoir of public works jobs should be in inverse ratio to the size of the miracles. It may be that a less than normal volume of public works will be required immediately to fill out the total construction demand. If private construction is found to be sufficiently miraculous to absorb all available construction labor and material, we should hold back our public works reserves until sagging of the construction line warrants committing our reserves to maintain the job capabilities of the construction industry. Under central control, that reserve power should be so directed that it will complement private industry but not compete with it for materials or labor.

When the war ends we still will be a nation with great natural resources and a productive capacity greater than ever before. We will be faced with the inflexible necessity of increasing our national income far above the prewar level. We will have an abundance of manpower—yes, and womanpower too—with which to produce the goods and services our own country and the war-devastated world will so sorely need. It remains to be seen if we have the intelligence and the faith to use our resources in a manner genuinely beneficial to ourselves and our Allies. Having planned well how we can win the war, we must also plan now to assure ourselves a future of peace, productivity, and prosperity.

Tampa Cures Its Water Distribution Ills

Elevated Storage and Trunk Mains Added to Existing System

By Glenn E. Hands, Assoc. M. Am. Soc. C.E.
Burns and McDonnell Engineering Company, Kansas City, Mo.

To improve the distribution of water over an enlarged service district, the City of Tampa, Fla., completed in 1943 a $2,000,000 construction program. Careful analysis of the system's deficiencies and of proposed additions disclosed a plan whereby a new storage unit and appropriately placed trunk main could provide adequate service. The analysis of the system and the design of the new units are here described by Mr. Hands. He also shows how existing facilities can be used to their maximum capacity by taking advantage of fluctuations in hourly demand.

ALTHOUGH the population of Tampa, Fla., is only about 125,000, in a closely built community, the municipally owned and operated water system serves the entire metropolitan area containing about 171,000 people. This area includes war industries and a military camp which are so located that the system is long and narrow, stretching nearly 17 miles from the pumping station to the most remote connection. Heavy demand at the far end of the lines resulted in low pressure and made it impossible to use four of the system's five elevated storage tanks. During dry weather, pressure was so low that water would not reach the second floor of homes in some areas during periods of peak load. An increase in pumping capacity was out of the question, as an application for priorities for this purpose had been refused by the WPB. Therefore a study of possible alterations in the distribution system was undertaken.

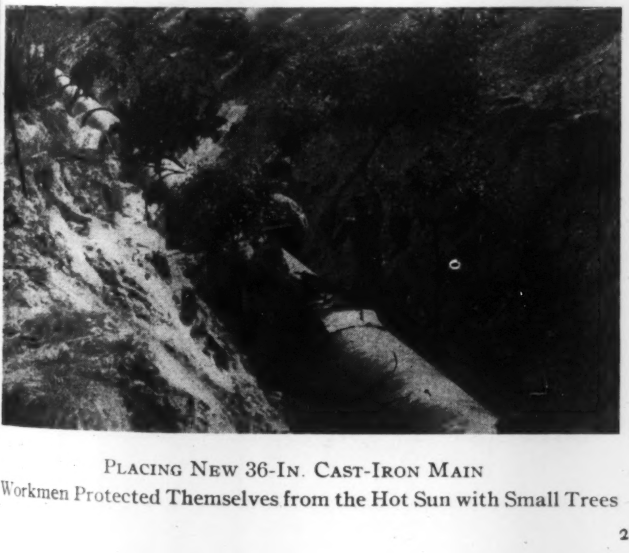
At the time this study was started, the city had planned a $2,000,000 improvement program for the distribution system. It was deemed advisable to have the plans that had been prepared reviewed by an engineering concern before the start of construction. The plans were reviewed by subjecting them to the Hardy Cross method of analysis, and the deficiencies were studied. Changes were then made in the layout to correct obvious errors and the system was again analyzed. The process was repeated for five different trial plans until one was finally evolved which would be satisfactory as well as economical and efficient.

EFFECT OF PEAK LOAD CHECKED

Before analyses were made of proposed improvements, the unimproved system was first analyzed for the peak hour of the maximum day then on record. This analysis was necessary for the following reasons:

1. To check the necessary assumptions and approximations used in the calculation of the Hardy Cross analysis for accuracy against actual results observed at that time.
2. To clarify certain vague points in the operation of the elevated storage on the system.
3. To determine, as nearly as possible, the deficiencies of the unimproved system under actual load conditions.

The trunk mains of the unimproved distribution system are shown in Fig. 1. Tampa obtains its water from the Hillsborough River, treats it, and pumps it into the system from a water plant located about five miles north and east of the heart of the city. In the unimproved system, water was delivered from the pumping station



Placing New 36-In. Cast-Iron Main
Workmen Protected Themselves from the Hot Sun with Small Trees

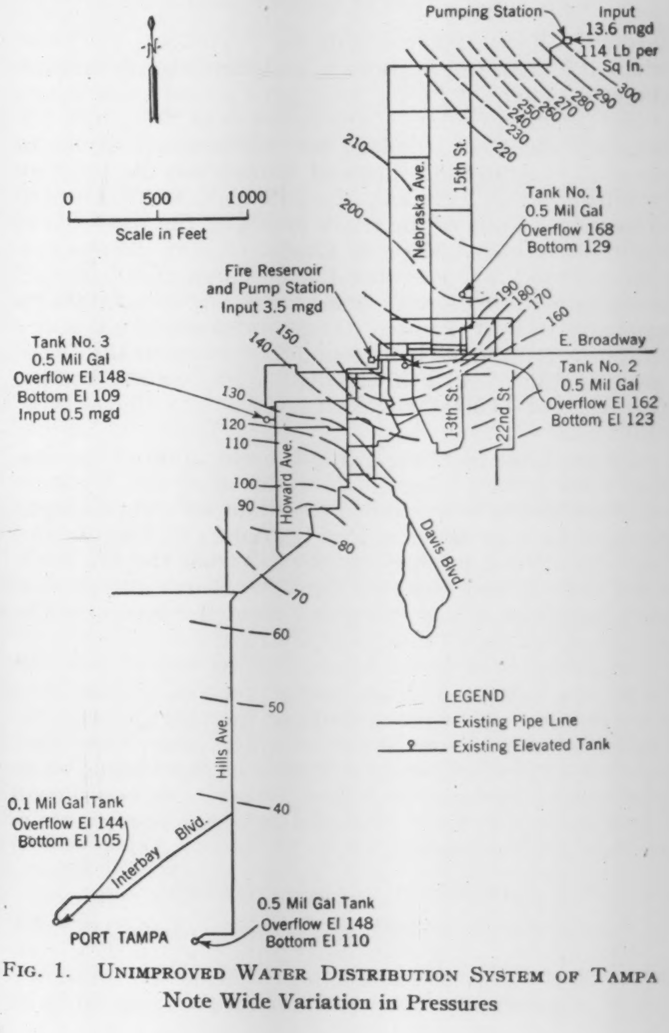

Pumping Station
Input 13.6 mgd
114 Lb per Sq In.
300
290
280
270
260
250
240
230
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
0
500
1000
Scale in Feet
Nebraska Ave.
15th St.
Tank No. 1
0.5 Mil Gal
Overflow 168
Bottom 129
Fire Reservoir
and Pump Station
Input 3.5 mgd
E. Broadway
Tank No. 3
0.5 Mil Gal
Overflow El 148
Bottom El 109
Input 0.5 mgd
Tank No. 2
0.5 Mil Gal
Overflow El 162
Bottom El 123
13th St.
22nd St
Howard Ave.
Davis Blvd.
Hills Ave.
LEGEND
Existing Pipe Line
Existing Elevated Tank
0.1 Mil Gal Tank
Overflow El 144
Bottom El 105
Interbay Blvd.
PORT TAMPA
0.5 Mil Gal Tank
Overflow El 148
Bottom El 110

Fig. 1. Unimproved Water Distribution System of Tampa
Note Wide Variation in Pressures

NEW STORAGE TANK OF 1,500,000-GAL CAPACITY

through a 30-in. cast-iron main for $1^1/_4$ miles to the point where it joined the grid system, and thence south through the grid system of 12-in., 20-in., and 24-in. trunk mains to the business center. Four mains (one 20-in., two 12-in., and one 16-in.) crossed the Hillsborough River to serve all of west and southwest Tampa and the interbay peninsular area, including MacDill Field at its southern extremity. None of the trunk mains on the west side of the river exceeded 12 in. in diameter. The Tampa system included four elevated tanks—three of 500,000-gal capacity within the city limits, and one of 100,000-gal capacity at Port Tampa. Three million gallons of fire storage was provided in a ground reservoir near the downtown section. A fifth elevated tank, owned by the Government, of 500,000-gal capacity, was located at MacDill Field.

All available facts regarding the operation of the system were gathered together for this analysis. Pressure and flow charts were studied to obtain the data on input to the system as shown in Fig. 1, totaling 17.4 mgd—13.6 mgd from the pumping station, 3.5 from the fire reservoir, and 0.5 from elevated Tank 3. It was learned that elevated Tank 1 was valved off from the system. The status of elevated Tank 2 was not clear.

Distribution of water-demand points and the amount were approximated from meter records. Peak-hour factors, estimated from a study of the characteristic demands of the various types of water users, were then applied. The coefficients of friction of the various water mains were assumed to follow a typical age-coefficient curve developed from a knowledge of the coefficients of two mains in the system.

HYDRAULIC GRADIENT PLOTTED

Results of the analysis are given in Fig. 1. Only the contour lines of the hydraulic gradients are shown for simplicity. The elevations are referred to mean sea level. Ground elevations in Tampa vary from 10 to 65 ft above mean sea level. A comparison between observed pressures and those calculated by the Hardy Cross method of analysis is given in Table I, illustrating the accuracy of the approximations and estimates necessary to make the analysis.

TABLE I. COMPARISON BETWEEN OBSERVED AND CALCULATED PRESSURES, IN POUNDS PER SQUARE INCH

GAGING STATION No.	LOCATION	CALCULATED PRESSURE	OBSERVED PRESSURE	DISCREPANCY
1	Hillsborough Pumping Sta.	115	115	0
2	Fire Station No. 7	75	75	0
3	Fire Station No. 5	55	60	5
4	Pump Station No. 3 Reservoir	67	70	3
5	Fire Station No. 4	56	55	1
6	City Hall	54	60	6
7	Fire Station No. 6	50	50	0
8	Fire Station No. 9	46	42	4
9	Elevated Tank No. 3	43	41	2
10	Gandy Blvd. and MacDill	11	13	3
11	MacDill Field	10	10	0
12	Port Tampa	10	14	4

Many of the vague points in the operation of the system were now clarified. The reason Tank 1 was valved off was apparent from an inspection of the contour lines; the hydraulic gradient was 32 ft above its top. Tank 2 was also off, as it was controlled by a Ross altitude valve to prevent overflow, and the hydraulic gradient was 20 ft above its overflow point. The hydraulic gradient passed through Tank 3 at El. 123, that is, 25 ft below its overflow point. Obviously the Port Tampa and MacDill Field tanks were empty. Therefore, of the five elevated tanks in the system, only one was functioning—No. 3, which was contributing at the rate of 0.5 mgd for equalization.

Pressure charts indicated that Tank 2 was in operation part of the day, but when the fire pumps were started, it was apparently refilled and the pressure raised above its overflow point. The pressure records indicated that this tank was never drawn down more than one-third of its capacity.

NEED FOR LARGER MAINS SHOWN

Obviously pipe sizes were entirely inadequate throughout most of the system; and the spacing of the contour lines revealed the "bottlenecks." With the overflow of Tank 2 a distance of 6 ft below that of Tank 1, and the overflow of Tank 3 another 14 ft lower; and with the hydraulic gradient between Tanks 1 and 2 dropping 18 ft,

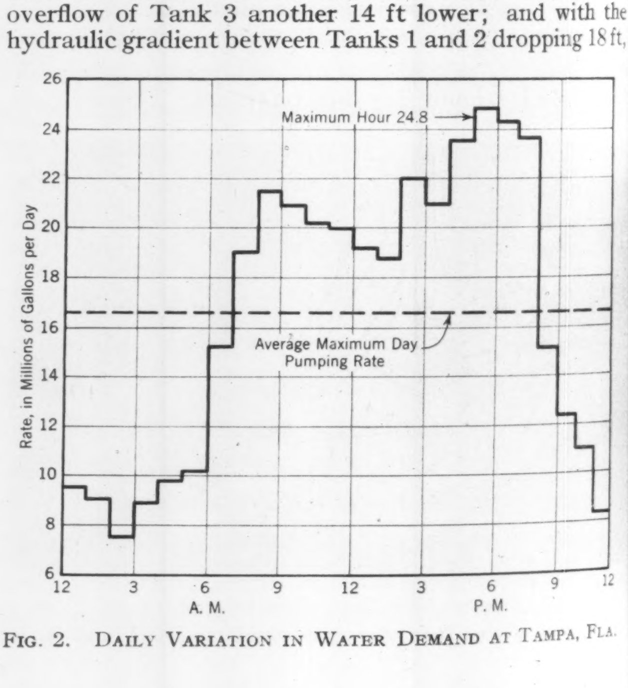


FIG. 2. DAILY VARIATION IN WATER DEMAND AT TAMPA, FLA.

nd that between Tanks 2 and 3 dropping 56 ft, it is bvious that these tanks could not "float" together on the nimproved system.

South of Tank 3 the gradient dropped rapidly, making impossible for the Port Tampa and MacDill Field anks to "float" with Tank 3. Obviously the elevated torage on the system was of little value in equalizing the umping loads. A part of the difficulty was due to indequate water mains, but whether or not additional ains would solve the problem was still a question. It as possible that the tanks were in the wrong locations or t the wrong elevations, and should be moved or raised, or bandoned in favor of a single larger tank properly loated at the proper elevation. Or perhaps a booster tation would prove more economical.

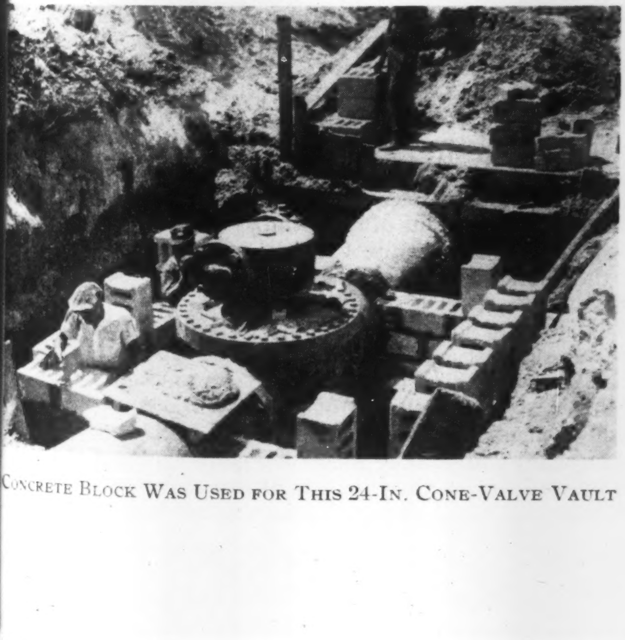
Plans for improvement were then analyzed—for a eak-hour demand approximately 50% greater than any revious demand then on record. A demand curve of he maximum is given in Fig. 2. The location of the reater part of this increase in demand was placed in the nterbay Peninsular Area, because of the growth already vident there. Also, industrial loads were added in areas here new industries were expected, and increases in Government demands were anticipated.

SEVERAL PLANS TESTED

Proposed improvements under Plan A included a new 36-in. main from the Hillsborough Pumping Station to he downtown area, where it branched into two 24-in. ains. One of these leads to the fire reservoir and connects with the 20-in. and 16-in. mains converging at that point; the other crosses the Hillsborough River and extends west and south to Bay Boulevard about a third of he distance down the Interbay Peninsula. In various localities 16-in. and 12-in. mains were proposed for extensions of service and for connections to existing mains n the system.

Under this plan and according to the analysis, the pressure at the pumping station would be 76 lb per sq in., while that at the southern city limits would be maintained at 58 lb per sq in. However, the Interbay Peninsula area to the south would still suffer from lack of capacity and pressure. The anticipated growth of industries on the east side of the city south of Broadway would obviously overload the 10-in. main on 22d Street and the 12-in. main on East Broadway.

It had been assumed that Tanks 2 and 3 would be operating to equalize pressures, adding 3.5 mgd to the system. It was noted, however, that the gradient was well above these tanks, making them inoperative. It was also assumed in the analysis that the Port Tampa and MacDill Field tanks were operating, contributing 0.7 mgd. The analysis showed that the gradient was below them, keeping them empty.



Concrete Block Was Used for This 24-In. Cone-Valve Vault

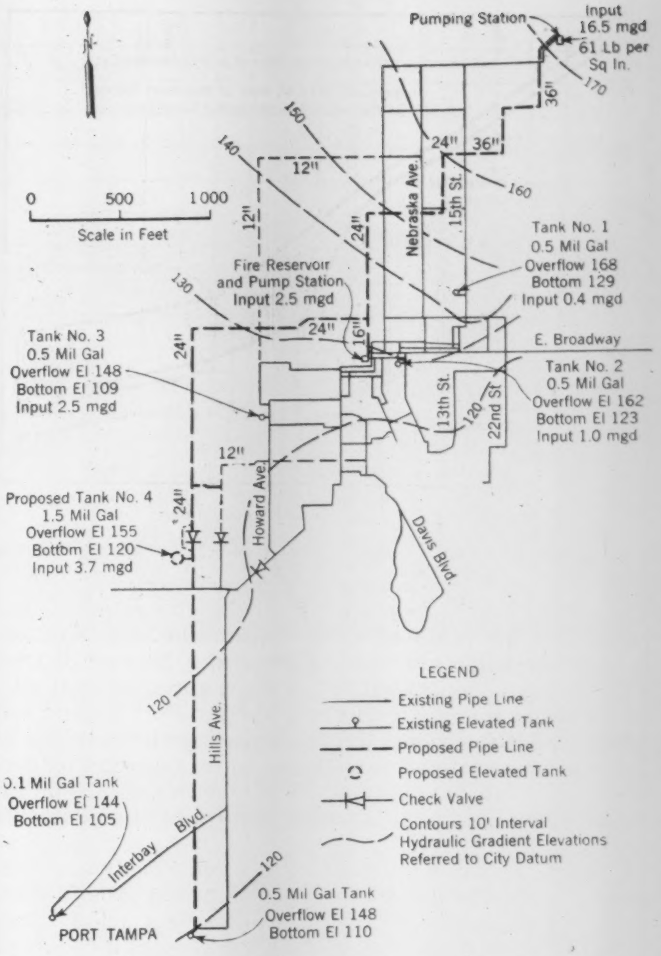

Pumping Station
Input
16.5 mgd
61 Lb per
Sq In.
170
160
150
140
130
120
36"
24"
36"
12"
12"
24"
24"
16"
24"
12"
24"
0
500
1000
Scale in Feet
Nebraska Ave.
15th St.
Tank No. 1
0.5 Mil Gal
Overflow 168
Bottom 129
Input 0.4 mgd
Fire Reservoir
and Pump Station
Input 2.5 mgd
E. Broadway
Tank No. 3
0.5 Mil Gal
Overflow El 148
Bottom El 109
Input 2.5 mgd
Tank No. 2
0.5 Mil Gal
Overflow El 162
Bottom El 123
Input 1.0 mgd
13th St.
22nd St
Proposed Tank No. 4
1.5 Mil Gal
Overflow El 155
Bottom El 120
Input 3.7 mgd
Howard Ave.
Davis Blvd.
Hills Ave.
LEGEND
Existing Pipe Line
Existing Elevated Tank
Proposed Pipe Line
Proposed Elevated Tank
Check Valve
Contours 10' Interval
Hydraulic Gradient Elevations
Referred to City Datum
0.1 Mil Gal Tank
Overflow El 144
Bottom El 105
Interbay Blvd.
0.5 Mil Gal Tank
Overflow El 148
Bottom El 110
PORT TAMPA

Fig. 3. Plan of Improved Water System at Tampa, Fla., Showing Hydraulic Gradient at Hour of Maximum Demand

The distances between contours showed where the "bottlenecks" existed in Plan A, and also that there was a possibility of overdesign in some of the trunk mains. Plan B, prepared as an improvement on Plan A, extended mains into the Interbay Peninsula area, reduced the length of 36-in. main by two-thirds, substituting 24-in. pipe, and added mains to the industrial area in the southeast part of the city.

According to the analysis of this plan, the pressure at the pumping station was 74 lb per sq in., and that in the industrial southeast was increased to 40 lb per sq in. Pressures in the Interbay Peninsula area were materially improved, becoming 33 lb per sq in. at Port Tampa and 24 at MacDill Field.

In the analysis, it was again assumed that Tanks 2 and 3 were serving as equalizing storage, contributing 1.0 and 2.5 mgd each to the system on the hour analyzed. The analysis showed that Tank 1 would also be functioning, because the hydraulic gradient passed below the overflow point. Recovery of the use of this tank was a valuable asset to the city, as it had not been functioning for several years.

Plan B was deficient in that the gradient remained too low to prevent the emptying of the Port Tampa and MacDill Field tanks. Plan B would have been satisfactory if the entire gradient system were raised 30 ft, increasing

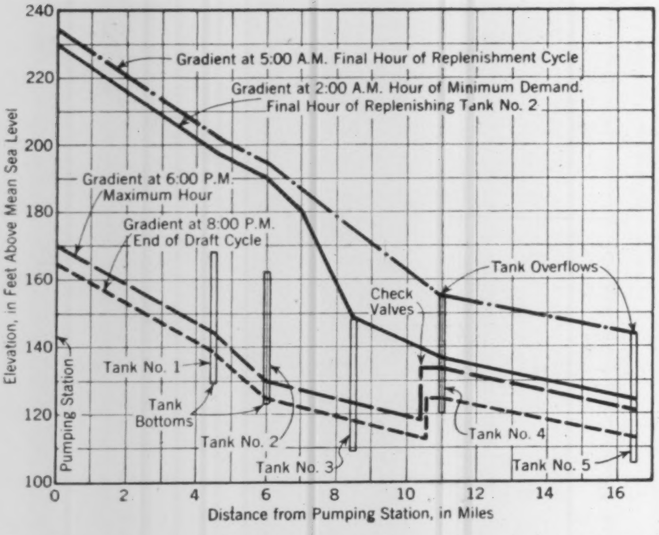


FIG. 4. HYDRAULIC GRADIENTS OF TAMPA'S IMPROVED SYSTEM

the pumping pressure to 87 lb per sq in. and requiring the raising of the elevated tanks within the city approximately the same amount. However, a booster district was worthy of consideration. It now appeared that adequate pressure could not be furnished to Port Tampa and MacDill Field without either increasing the pressure at the pumping station by 15 lb per sq in. (thereby rendering all three of the existing tanks in the city useless unless raised), or providing a booster station in the peninsula area.

Plans C and D were analyses of these two alternatives. Plan C provided for a booster station and ground storage. Plan D provided for the abandonment of the three elevated tanks in the city and the addition of a new tank at the proper height to supply adequate pressure to Port Tampa and MacDill Field. Both of these plans were satisfactory in that they provided ample pressure at the extremities of the system. However, Plan C would increase operational costs in the form of electric power and labor. Plan D had the objection of including abandonment of useful storage, and construction of new storage which merely replaced that abandoned. Space forbids inclusion here of the analyses of Plans C and D.

ADDITIONAL ELEVATED STORAGE

The answer to the objections to Plans C and D was found in the development of Plan E, shown in Fig. 3. This plan, the one adopted, is very similar to Plan C, except that an elevated tank of $1^1/_2$-million gal capacity is substituted for the booster station, and the elevated tank is placed sufficiently high to provide ample pressure to the extremities of the system when required. The peninsula area can be check-valved off so that the pressure can drop sufficiently in the city area to bring into full use the equalizing value of the existing tanks there, and all the check valves are provided with a by-pass so that the storage capacity of the tank can be extended back into the system if desired. The tank is readily filled at night by an increase in pressure at the pumping station, and is of ample capacity to serve the area during the hours of peak demand.

It was assumed in the analysis of Plan E that all the tanks were operating as equalization storage, but that Tank 1 was contributing only 0.4 mgd; Tank 2, 1.0 mgd; and Tank 3, 2.5 mgd, as shown in Fig. 3. The analysis revealed that Tank 2 would be drawn lower with respect to its overflow than either Tank 1 or Tank 3, and would therefore contribute at a greater rate than had bee assumed.

In determining the conditions for refilling the tank during the night, an analysis of the system was made fo the minimum hour of the maximum day. The rates of refilling of the tanks were approximated by an inspectio of the demand curve, Fig. 2. It was assumed that on th minimum hour, Tanks 1 and 2 were full and that Tank 3 and 4 were filling at a rate of 3.2 and 5.2 mgd, respectively. The analysis indicated that Tanks 1 and 2 wer full as assumed. Tank 3 was at the overflow point, o the verge of shutting off. Tank 4 (the proposed tank was filled to El. 136. The analysis also showed that th pressure at the pumping station would have to b increased to 85 lb per sq in. in order to force the wate into the tanks.

HEAD AT PUMPS VARIES CONSIDERABLY

Profiles of the hydraulic gradient at various times in th cycle of draft and fill on the maximum day are given i Fig. 4. The development of this exhibit indicated th necessary range in pumping heads required to allow fu use of all the storage on the system. At the completio of the filling cycle, the pressure would reach 87 lb per s in., and at the end of the cycle of draft the pressure shoul drop to 58 lb per sq in. The range is therefore 29 lb pe sq in. The characteristics of the high-service centrifuga pumps were then checked to ascertain the feasibility o operating over this range of head. From field data, i was estimated that the rate of pumpage would var approximately 4.0 mgd over this range of head. This i an advantage because it provides the greater rate of flo during the hours of high demand, which in itself has a equalizing effect.

The construction program for the distribution syste was finished with the completion of the new 1.5-millio gal elevated tank in October 1943. Improvement needed at the purification plant and pumping statio have been held up by war priorities. This has prevente a completely satisfactory check on the design developed But many of the improvements produced good results i pressure and flow distribution before the entire syste was completed. Tank 1 was placed in operation befor the pipe-laying program was 50% complete. Pressure at MacDill Field and Port Tampa improved every time trunk main was placed in operation on the west side o the Hillsborough River. The pumping pressure droppe from 114 to 75 lb per sq in. the day the 36-in. main wa put in operation.

Because the program for improving the water plan and pumping station had to be deferred, the new elevated tank has proved a "lifesaver" in relieving peak demands on the pumping station. The tank has been effective in equalizing the daily load. Flow during a typica day varied only from 15 to 20 mgd, and the pressur varied from 52 to 92 lb per sq in. The higher pressur and the low flow occurring in the early hours of the morning indicated that the tanks were filled and that th water demand dropped off as the valves of the elevate tanks closed. One of the pumps was shut off at 6:00 a.m. reducing the pressure to 85 lb per sq in. In all parts o the distribution system pressures have been sustaine above 35 lb per sq in., except on occasions when th capacity of the pumping station has been exceeded.

Revisions and additions to the distribution syste were under the direction of J. S. Long, Superintendent o the Water Department of the City of Tampa. Engineering consultants were the Burns and McDonnell Engineering Company. The 1,500,000-gal elevated storage tank was erected by the Chicago Bridge and Iron Company.

Repairs to Buck Power House and Dam

By **Philip Sporn**, M. Am. Soc. C.E., *and* **H. A. Kammer**, Assoc. M. Am. Soc. C.E.

Respectively Vice-President and Chief Engineer; and Construction Engineer, American Gas and Electric Service Corporation, New York, N.Y.

DISINTEGRATION of the concrete forming the dam and power house of the Buck Hydroelectric Plant made it essential to undertake extensive repairs. This plant of the Appalachian Electric Power Company was built on the New River in Carroll County, Va., in 1912. Since that time the concrete surface has failed progressively. By 1928 the condition of the downstream face of the bulkhead, the power-house walls, and the spillway had become so bad that it was decided to remove and replace the defective concrete surfaces of these structures.

In 1928 it was believed that weathering of the concrete, which had been placed as a very wet mix, was the primary cause of the trouble. The disintegration was greatest in the lower half of the bulkhead section of the dam, where the old concrete was removed to a depth of 18 in. A new facing was placed on this section, reinforced on the rear side, and anchored to the old concrete with hooked dowels. Vertical and horizontal drains were provided to take care of water seeping through the main body of the dam. This method was also used to repair disintegrated surfaces of the other structures.

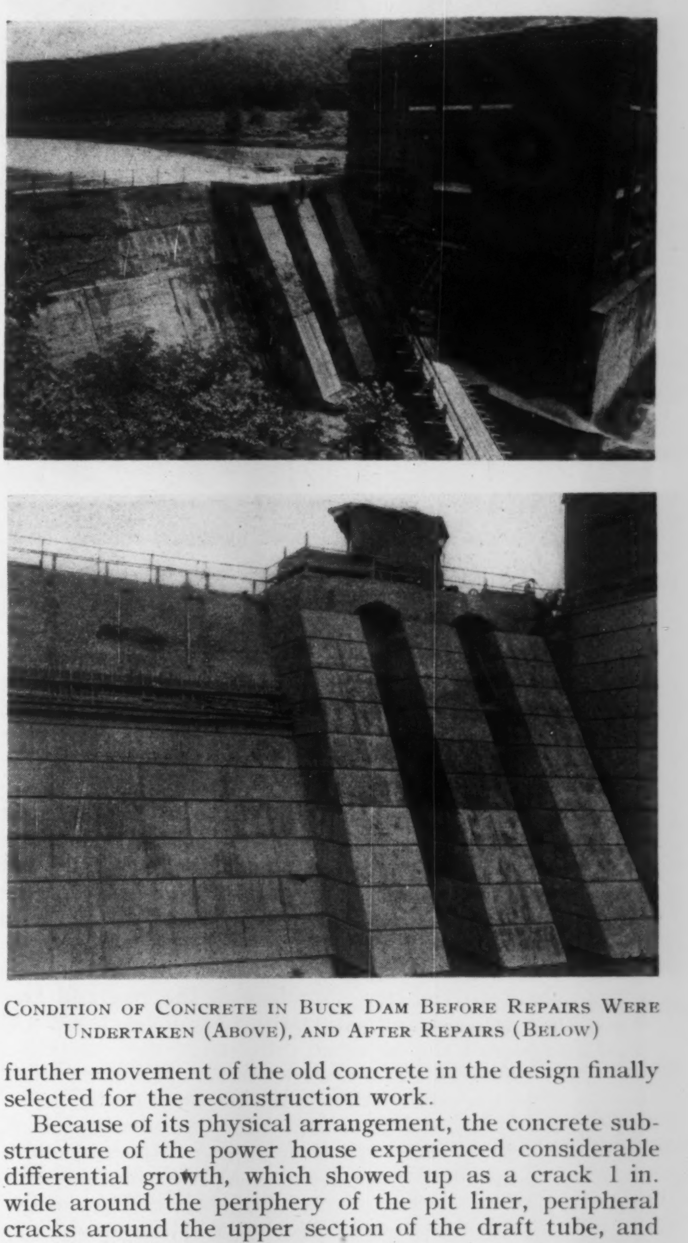
By 1938 the repair work had failed to the extent shown in the accompanying photographs. The failure of this work, repaired with concrete which was mixed and placed under more rigid and better specifications than the original surface, led to the idea that the earlier diagnosis of the reason for the disintegration was incorrect.

An investigation to determine the true cause of failure was therefore started. Briefly, the studies demonstrated that there was a chemical reaction between the phyllite aggregate and the high-alkali cement used in the original structures. The products of this reaction caused serious expansion of the concrete. This finding explained to a considerable extent not only the deterioration of the original structures and the concomitant effects on embedded turbine parts, but also the premature failure of the repairs made only ten years previously.

It is the opinion of the authors that the disintegration cycle of the concrete at Buck Dam is typical of cycles which, once started, move on at a self-accelerated rate. The expansion creates stresses which crack the exterior faces. Water enters these cracks and freezes during the winter, causing further opening and spalling of the face. Further growth of the old concrete widens the cracks, and the next freeze aggravates the situation still more; so the cycle goes on, causing the disintegration to extend more and more deeply into the old concrete.

CONTINUOUS GROWTH OF OLD CONCRETE EXPECTED

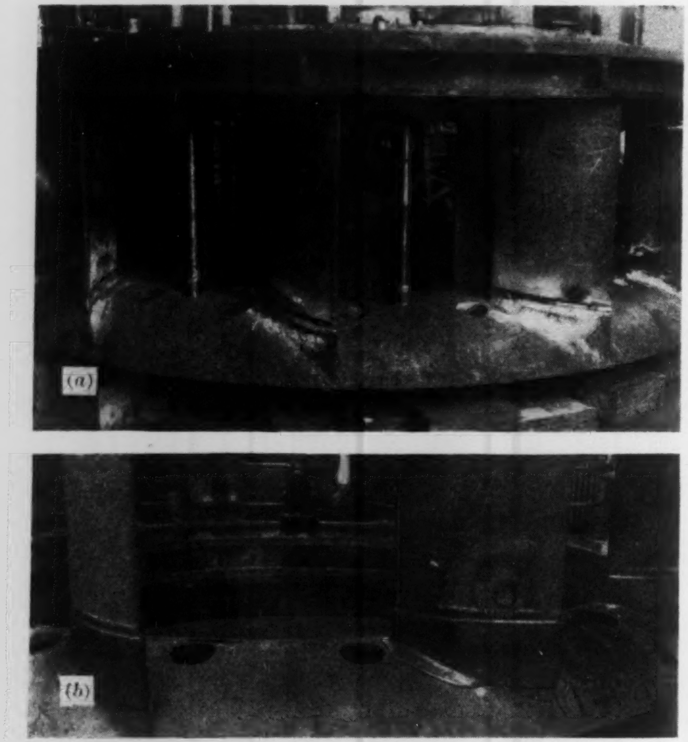
The tests at the Massachusetts Institute of Technology in 1938–1941 (R. W. Carlson and H. A. Kammer, "Investigation of Causes of Delayed Expansion of Concrete in Buck Hydroelectric Plant," *Journal of American Concrete Institute*, June 1941), and observations of the action of the power-house substructure during the 1928–1941 interval, very definitely show that further expansion of the old structures can be expected. This finding had a major bearing on the several different schemes considered for repairing the deteriorated concrete. Since nothing could be done to prevent further expansion, and because it would be economically impractical to demolish the old structures entirely, it was decided to make provision for further movement of the old concrete in the design finally selected for the reconstruction work.



Condition of Concrete in Buck Dam Before Repairs Were Undertaken (Above), and After Repairs (Below)

Because of its physical arrangement, the concrete substructure of the power house experienced considerable differential growth, which showed up as a crack 1 in. wide around the periphery of the pit liner, peripheral cracks around the upper section of the draft tube, and breaking of the speed-ring stay vanes. As a consequence the water turbine and generator failed to maintain proper mechanical alinement.

In order to repair the power-house substructure and machine foundations (as shown in the sectional drawings, Fig. 1), the concrete which supported the generator and turbine was removed from the generator floor down to a level about 5 ft below the floor of the scroll case. The exposed face of the old concrete was then rebuilt to a smooth surface where it adjoined the new concrete foundation. The facing was built up on the old surfaces to a depth of 6 in. by the "Prepak" method, according to which the forms are first packed with aggregate and then grouted to refusal at a pressure of about 50 lb per sq in. with a sand-cement grout. All aggregates were dolomitic limestone.



WELDED AND RIVETED REPAIRS TO CAST-IRON SPEED RING
(a) Fractured Vanes Built Up with Bronze for Alinement,
(b) Envelop Patches in Place

Because the old concrete was of inferior quality and quite porous, it was expected that a better bond would be obtained between the old and the new work by the Prepak method than by conventional types of concrete placement. Further, because the new concrete facing was comparatively thin, and the height of the lifts that could practicably be used would be so great, it was thought that ordinary placement methods might not give satisfactory results. Cores drilled from the repaired structure show that an excellent bond was obtained with the method employed

Wherever the restored Prepak face of the old concrete was adjacent to the new foundation, the restored face was coated with a bitumastic paint in order to break the bond and permit the expected differential movement between the new and the old structures. The same thing was done for the contraction joints between units.

To prevent water leakage through the painted joints, a groove, filled with synthetic-rubber expansion-joint filler, was provided around the periphery of the scroll case and the draft tube. As a further precaution, a copper water-stop was also used. After the new facing had been placed on the old concrete and painted, the new foundations for the water turbines and generators were cast and vibrated in place by conventional methods.

The differential movement of the old concrete substructure of the power house had not only caused the rotating parts of the water turbine to wear unevenly, but had also caused fractures in the cast-iron speed ring. As a matter of fact, each of the stationary vanes of the latter was broken through at either the top or the bottom.

For the repair of the speed ring, a continuous box-type or envelop patch was used, consisting of an envelop of $^5/_{16}$-in. steel plate, which was shrunk tight and continuous around the broken joint. It is held in place by $^3/_4$-in. patch bolts and welded at the upstream and downstream ends of the vane. Before the envelop patch was applied, studs were threaded and brazed into the fractured surface on each side of the break. The fractured ends of all vanes were then built up with bronze to partially close the break. After all the sections of the speed ring had been properly alined, opposite studs were joined with a full-strength weld. The envelop patch was then applied.

The exterior walls of the power-house substructure, bulkhead sections of the dam, spillway sections, piers, etc., all showed the effects of the unusual expansion of the concrete. The north bulkhead section of the dam was probably in the worst condition, and the method employed to repair its downstream face is typical for all.

The disintegrated concrete was removed to an average design depth of 4 in. Whenever it was found in the field that the disintegration extended deeper than 4 in., the disintegrated concrete was removed accordingly, and in the case of one small section, to a maximum depth of 18 in. Where leakage was taking place through horizontal construction joints of the old concrete, stage grouting was effectively used to stop the flow. After the leakage had been stopped, the structure was rebuilt to its original lines by the Prepak concreting method.

Because it has been definitely determined that the old concrete within the body of the dam will continue to grow, the new 4-in.-thick facing was divided into panels 3 ft 4 in. high by 8 ft long, separated by V-joints. The V-joint consists of a 2-in. notch in the facing concrete, and it is expected that as further growth takes place the face will crack at the V-joints. By controlling the future cracking of the new facing in this manner, it should be comparatively simple to caulk or seal, by conventional masonry-wall repair methods, any cracks that may develop in the future. Drains have been installed behind the new facing to prevent the building up of pressure or the freezing of water which may seep through the main body of the dam despite the grouting work that was done.

Forms were constructed one lift (about 6 ft) in height all the way across the bulkhead section. After they were packed with aggregate, the forms were sealed at the top and a sand-cement grout mixture was injected. The finished surface is smooth and dense, and presents a good appearance.

The work was performed by the owner's construction organization, with F. A. Aldred as superintendent in charge of the work in the field. The speed-ring repairs were carried out under the supervision of E. T. Davis, and the Prepak concrete was placed by Intrusion-Prepak, Inc., Chicago, Ill. The authors supervised the design and reconstruction of the entire project.

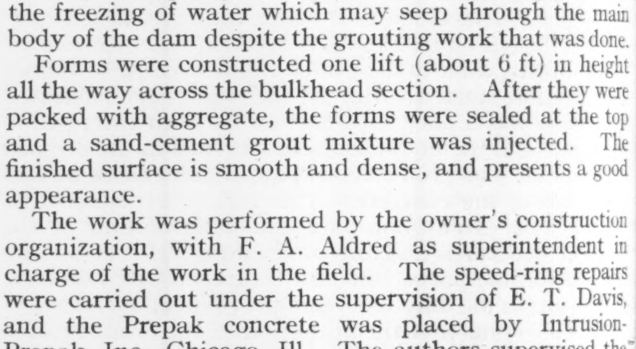


FIG. 1. SECTION DRAWING SHOWING REPAIRS TO POWER-HOUSE SUBSTRUCTURE

Aerial Photos Map Route for Transcontinental Telephone Cables

By J. L. BERGGREN

DISTRICT PLANT ENGINEER, THE PACIFIC TELEPHONE AND TELEGRAPH COMPANY, SACRAMENTO, CALIF.

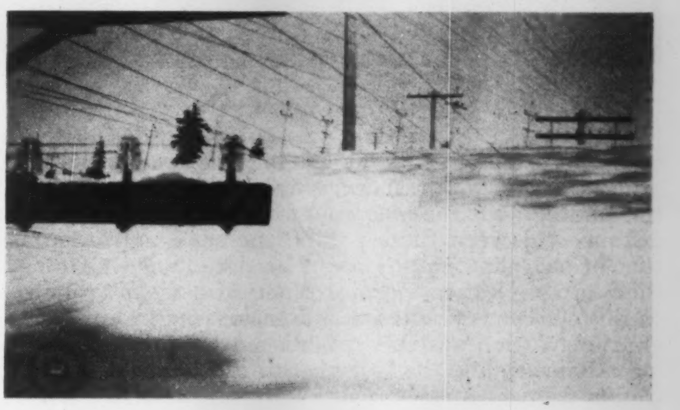
ADDITIONAL communication facilities from coast to coast have been provided with the completion of the Bell System's twin buried cables between Omaha, Nebr., and Sacramento, Calif., at a cost of 25 million dollars. Previously cable facilities were available from the Atlantic Coast to Omaha and from Sacramento to San Francisco and Los Angeles. To make these facilities continuous, it was necessary to place cables between Omaha and Sacramento, a distance of about 1,600 miles. Work in the territory of the Pacific Telephone and Telegraph Company and the Bell Telephone Company of Nevada, involved a section 500 miles in length from Sacramento, Calif., to Wendover, Utah. Since the author's direct connection with this project was largely confined to the section of the cable passing through the Pacific Company's territory, this article deals largely with that particular part of the undertaking. Parts of this route traversed extremely rugged terrain, particularly over the Sierra Nevada in California and the high mountain ranges in Nevada.

The route for the cables was chosen primarily from the standpoint of assuring continuity of service; that is, it was placed in a location that would avoid service interruptions caused by fires and wind-felled trees, slides, highway slipouts, floods, and snow damage. Also, the location was chosen to avoid excessive induced voltages caused by parallel high-voltage power lines.

To secure the best possible location, aerial photographs were taken of the entire route. The pictures were taken approximately every 20 seconds at a plane speed of 120 miles an hour at elevations from 12,000 to 18,000 ft, and at a predetermined scale of 1,500 ft to the inch. Each contact print (9 by 9 in.) therefore pictures an area approximately $2^1/_2$ miles square. Rather than take a picture every $2^1/_2$ miles of flight, which would have covered the entire area, it was decided to take them at about 1-mile intervals; this gave a minimum of 60% overlap. As a result the image of any object on the ground appears in three consecutive photographs.

The purpose of this coverage was twofold. First, in the study of any particular area, the engineer could choose the one of the three photographs on which the area appeared near the center of the print. This eliminates a good part of the displacement and loss of detail which exist near the outer edges of a picture, particularly in the case of rugged country where there are mountains and canyons differing considerably in elevation. Second, the 60% overlap provided views of an object on the ground—such as a tree, house, or even a mountain—from three different camera positions. By inserting two consecutive photographs in a stereoscope, the third dimension, or relative depth, was apparent.

This aerial survey afforded outstanding advantages in the type of terrain encountered across Nevada and the Sierra Nevada range. The first application of aerial photographs to the problem was in a reconnaissance of the area to determine the most feasible route for the cable. Without photographs, this is a laborious job involving weeks and months of scouting the country, fighting brush, climbing mountains, investigating every possibility in the field, until the best possible route has been assured. With photographs and a stereoscope, all aspects of the area are examined at the desk of the engineer, and 75% of this scouting is avoided.

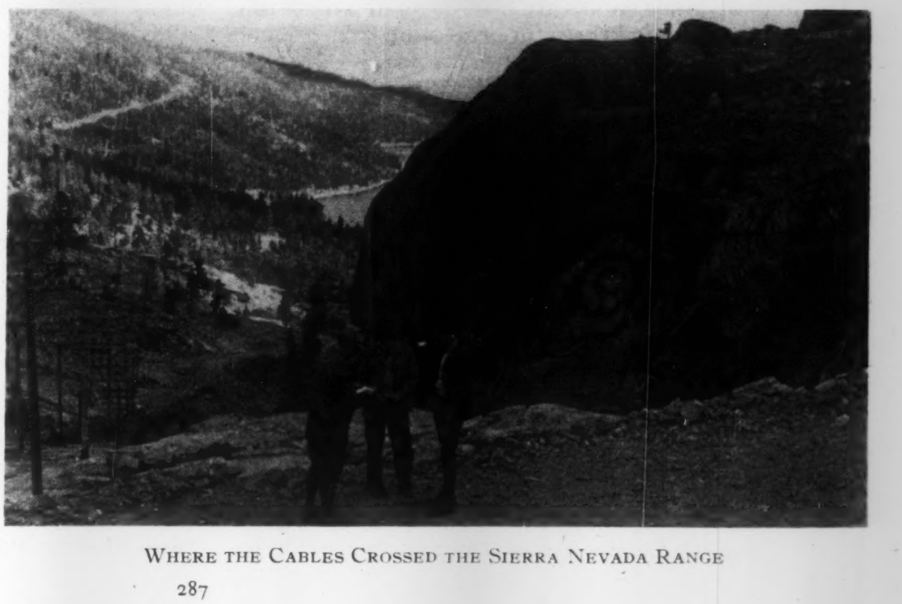


BURIED CABLES ELIMINATE INTERRUPTIONS DUE TO EXTREME WEATHER CONDITIONS

Snow Has Covered the Two Bottom Crossarms on These 35-Ft Poles in the Sierra Nevada

GROUND CONTROL OBTAINED FROM EXISTING SURVEYS

To eliminate the extensive preliminary location surveys that must normally be made by field crews, "ground control" of the aerial photographs was established. "Ground control" in general was obtained by the use of existing surveys of state highways or rail-



WHERE THE CABLES CROSSED THE SIERRA NEVADA RANGE

A COMPLETE CABLE-LAYING TRAIN

roads. Various points along the highways such as bridges, culverts, and curves were easily identified on the photographs. Thus from the known courses and distances between these points, the scale and orientation of the photographs could be determined. Across the State of Nevada, because of the absence of highway or railroad survey notes, it was necessary to make use of triangulation systems established by the U.S. Geological Survey and the Nevada State Highway Planning Commission.

A set of the photographs was prepared showing all the engineering data developed in the office. Such a set and a pocket-size field stereoscope were furnished to the surveyors, enabling them to reproduce the route chosen by the location engineer. The field stereoscopes were employed to verify actual locations on the ground with respect to the photographs. When changes in the route became necessary on account of some unforeseen obstacle, the photographs gave more help than could be obtained by scouting ahead through brush and timber over rough country.

It was necessary to organize a movable camp for the engineers, and this was used throughout the greater part of Nevada, where living accommodations were not available. From the start of this job, all other considerations were subordinated to that of safety and the avoidance of accidents in the accomplishment of both the engineering and the construction work.

The long-distance cables are lead-covered with a tape armor wrapped around them for protection from gophers and other rodents that seem to like lead. Over the tape is a jute or thermoplastic protection for the purpose of avoiding corrosion. Across rivers, streams, and gullies, wire-armored cable was placed for additional strength.

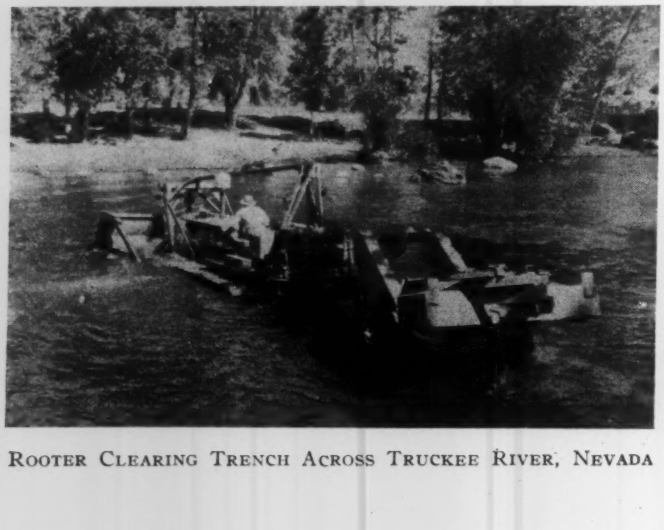
These cables were laid in everything from solid granite, over the Sierra Nevada in California, to marshy salt flats in Nevada. For the most part they were placed simultaneously by plows and associated special equipment designed by the Bell System for cable-burying projects. The cablelaying train consisted of three continuous-tread tractors, each operated by 113-drawbar-hp diesel motors; three cable-reel trailers; one rooter plow; and one cable-laying plow.

First the rooting plow is pulled over the chosen location by two and sometimes three tractors, and a slot is cut to the full depth (or slightly greater) to which it is planned to place the cables. This operation clears all subsurface obstructions such as roots and boulders, and breaks up hardpan formations. Then the cable-laying plow and two cable-reel trailers are towed along the line by two of the tractors. The third tractor and the third trailer are required for loading the cable reels onto the two trailers of the cable-laying train. A whistle or Klaxon horn is provided for signaling the tractor drivers to start or stop the train.

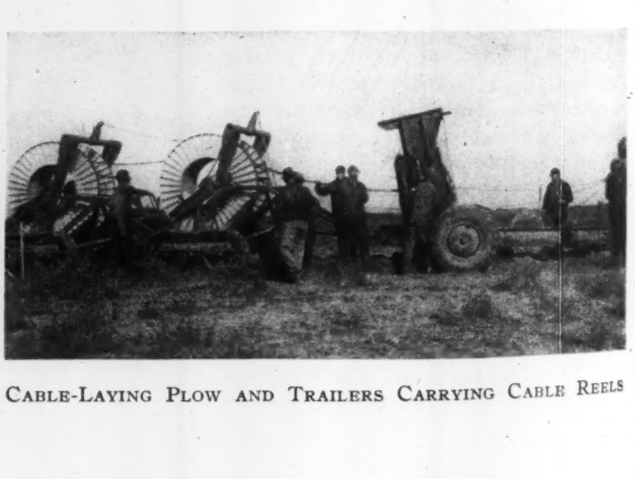
The cable-laying plow share passes along the slot made by the rooting plow. The cables feed into the back of the share of the plow and emerge from an opening at the bottom. The share is raised and lowered by power furnished by one of the tractors. As the cables pass into the plow share they are sprayed with a light lubricating oil by means of a pressure spray. This is required in order to avoid excessive strain on the cables as they pass through the share and are plowed into the ground.

The cable on the reels is placed under nitrogen gas pressure at the factory. This pressure is measured before the cable is plowed in to determine whether or not there is a leak. If the pressure is not up to the proper point, the cable is not placed until repairs have been made.

Under the best of conditions it was possible to place about 17 trench miles of cable per five-day week with the cable-burying equipment. The cable was laid across many rivers, and at numerous locations the water was above the floor of the tractors. Two years of steady construction work across plains and mountains were required to build the transcontinental cable line—a remarkably short period of time considering the amount of work involved.



ROOTER CLEARING TRENCH ACROSS TRUCKEE RIVER, NEVADA



CABLE-LAYING PLOW AND TRAILERS CARRYING CABLE REELS

Cost-Plus-a-Fixed-Fee Contracts of the Navy Bureau of Yards and Docks

By HOWARD P. MAXTON, ASSOC. M. AM. SOC. C.E.
HEAD, DIVISION OF ACCOUNTING AND AUDITING, BUREAU OF YARDS AND DOCKS, NAVY DEPARTMENT, WASHINGTON, D.C.

DURING the past several years, some of the largest construction contracts ever undertaken have been carried to completion on the cost-plus-a-fixed-fee basis. Because of the extreme emergency under which Naval facilities had to be constructed, the Bureau of Yards and Docks sought a type of contract that would permit a pooling of the resources of engineering and construction manpower. The fixed-fee procedure which was authorized met that need and also permitted the flexibility essential to rapid progress of the work.

A NEW chapter, the greatest in the annals of the Navy Civil Engineer Corps, can now be written. It began in the summer of 1939 when the first of the Navy cost-plus-a-fixed-fee construction and engineering contracts were negotiated for the outpost defences of our country in the Pacific, Alaska, and West Indies areas. At that time, the Chief of Civil Engineers of the Navy, Vice Admiral Ben Moreell, Hon. M. Am. Soc. C.E., negotiated three fixed-fee construction contracts, and one architectural-engineering contract, which became the pattern for more than four hundred construction, and fifty architectural-engineering contracts subsequently negotiated. That this type of contract is fundamentally sound and can be successfully administrated has been proved in the $2^{1}/_{2}$ years that have elapsed since our country was drawn into a war which has required the greatest Naval shore construction program in our history.

The usual lump-sum or unit-price form of contract, based on free enterprise and competitive bidding, basically sound and superior in normal times, lacked the speed of accomplishment and flexibility necessary in an emergency. Time was too short to prepare the detailed plans and specifications necessary for competitive bidding. Only some form of contract that would permit a pooling of the experience, talent, and resources of the country's engineering and construction manpower could have accomplished the tremendous job now being successfully concluded.

Congress recognized this fact and on April 25, 1939, passed an act authorizing the Bureau of Yards and Docks to negotiate contracts for construction work outside the continental limits of the United States. By the same act, the Bureau obtained legislative authority to engage outside engineers and architects to assist in the preparation of plans and specifications. In subsequent legislation, Congress extended the use of the cost-plus-a-fixed-fee type of contract to continental work.

In May 1940, the late William M. Smith wrote a booklet entitled "Some Commentaries on 'Cost-Plus-a-Fixed-Fee' Contracts with Particular Reference to U.S. Navy Contracts Under the Bureau of Yards and Docks." The basic concepts enunciated in this treatise are as true and strong today as when they were written. A review of the operation of the Navy's fixed-fee contracts would be incomplete without quoting some of "Bill" Smith's fundamental truths. In part, he said:

> "There must be a high degree of cooperative confidence and trust by each of the parties in the other and this confidence and trust must extend throughout the organization of each party.
>
> "To insure a successful accomplishment of the purpose of a cost-plus contract there must be the utmost of cooperation. . . . Errors of judgment and mistakes will, of course, be made, but the good faith of the person involved should not be questioned; to do so only creates resentment and makes inroads on the spirit of cooperation.
>
> "There must also be a high degree of individual courage and willingness to assume responsibility in those who are charged with the burden of making decisions. Where speed of accomplishment is of prime importance, as it almost always is under a cost-plus contract, prompt decisions are essential. . . . Precedents should not be permitted to hamper any action which appears desirable. . . . The injunction 'Be just and fear not' is as potent now as when the words were penned by Shakespeare."

The Navy Fixed-Fee construction and architectural engineering contracts are essentially partnership agreements. The form of the contract is simple. It contains stereotyped "articles" covering such controlling subjects as "Plant and Equipment," "Plant Loss or Major Damage," "Services and Labor," "Materials," "Grade of Materials and Workmanship," "Inspection," "Records and Accounts," "Compensation," etc. The construction contracts differ one from another merely in the article, "Work to Be Done," and this article simply contains a list of "projects" with the estimated cost of each. Frequently contractors ordered plant and material, established their organizations, and started construction with only a "Letter of Intent" in their pockets! The formal contract came later.

SELECTION OF CONTRACTORS

To a large extent the satisfactory and speedy accomplishment of the various types of engineering and construction work depended upon the proper selection of engineers, architects, and contractors. A Board to Negotiate Fee Contracts, composed of five members, including the sponsoring Bureau Project Manager, was set up to make the selections for the construction contracts. The law requires that the Bureau negotiate with

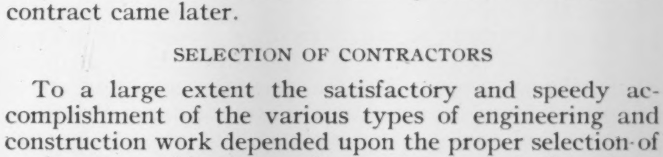

BUREAU OF YARDS AND DOCKS
CHIEF OF BUREAU
ASSISTANT CHIEF OF BUREAU
CONTINENTAL
SUPERINTENDING CIVIL ENGINEERS
AREAS I TO VII INCLUSIVE
EXTRA-CONTINENTAL
DIRECTORS
ATLANTIC DIVISION
PACIFIC DIVISION
ALASKAN DIVISION
ADMINISTRATION AND PERSONNEL DEPARTMENT
PROGRESS CONTROL AND STATISTICAL DEPARTMENT
FINANCE AND OPERATING DEPARTMENT
PLANNING AND DESIGN DEPARTMENT
CONSTRUCTION DEPARTMENT

FIG. 1. ORGANIZATION CHART OF THE BUREAU OF YARDS AND DOCKS

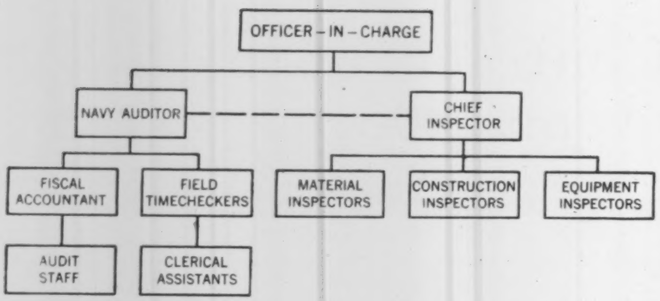


FIG. 2. TYPICAL ORGANIZATION FOR FIELD CONTROL OF FIXED-FEE CONTRACTS

at least three contractors of its own selection. Contractors of known responsibility and reputation who possessed the necessary resources and ability to organize their work with experienced men and adequate equipment were invited to sit with the Board to demonstrate their experience, ability, and fitness. Sometimes a single firm was selected; often, and more generally for the larger contracts, two or more firms joined together to tackle the venture, combining organizations, equipment, and financial resources and pooling experience.

The contractor or contractors prepared no bids and generally negotiated for no fee. They negotiated only for the work, established their ability and resources, financial as well as technical, organization and plant, and agreed to accomplish the work with the necessary dispatch and according to the terms of the contract. The fee was set at a fixed sum by the Chief of the Bureau upon recommendation of the Negotiating Board. This fixed fee was changed only for subsequent changes in the scope of the work. Change Orders and Supplemental Agreements requiring additional work increased the fee; those decreasing the scope of the work required a reduction in the fee.

Many contracts were enlarged by changed orders and supplemental agreements to two or three times, or more, their original scope. The fee originally was determined by the Bureau Negotiating Board after reviewing (1) the size and scope of the contract, (2) inherent hazards of construction, and (3) location. Thereafter the fee, a fixed amount, was increased or decreased with an increase or decrease in scope. The contractor would have nothing to gain and much to lose by not safeguarding the Government's interests or by being extravagant, since his reputation would be at stake.

ARCHITECTURAL-ENGINEERING CONTRACTS

Some of the architectural-engineering fixed-fee contracts covered the design of all structures and complete facilities. In these cases the architect-engineer subcontracted any specialized design work that he was not qualified or organized to handle. In other instances, the Bureau divided the design work into the several specialized fields and entered into separate contracts with qualified firms.

Architects and engineers were selected for their experience and ability. Local individuals and firms were given preference, other things being equal, and consideration was given to the amount of work an architect or engineer had on the board at the time. The selection usually was made as the result of local investigation and recommendations received from the Officer-in-Charge of Construction in the field. If the Construction Department of the Bureau concurred, the recommendation was forwarded to the Chief of the Bureau for approval.

In carrying out its enormous program for the construction of shore facilities under fixed-fee contracts, the Bureau of Yards and Docks has utilized the organizations and resources of more than 400 construction and 40 architectural-engineering firms. The difference in numbers between the construction and the architectural-engineering firms is due largely to the following factors: (1) much of the design work was done by the Design and Planning Department of the Bureau of Yards and Docks, which developed many standard designs; (2) the construction contractors sometimes designed in the field; and (3) it often proved feasible to handle much of the design work on a lump-sum basis. In addition, the fixed-fee contractors employed the services of thousands of lump-sum and fixed-fee subcontractors. In the aggregate, this expansion of the shore facilities and some advance-base work of the Navy Department totals more than four billions of dollars in expenditures under fixed-fee contracts.

CIVIL WORKS CONTRACTS

On March 21, 1942, by order of the Secretary of the Navy, the Bureau of Yards and Docks assumed jurisdiction over the design and construction of "Civil Works" contracts for industrial plant facilities. These total an additional $450,000,000. These contracts are in reality subcontracts under supply contracts between the originating bureau—Bureau of Ships, Bureau of Ordnance, or Bureau of Aeronautics, and industrial and manufacturing concerns. They are for plant construction and expansion. In these cases, the bureaus concerned delegated responsibility for engineering and construction to the Bureau of Yards and Docks. Occasionally, the contracts extended to the procurement of machinery, tools, and equipment.

ORGANIZATION OF THE BUREAU OF YARDS AND DOCKS

The administration and control of this rapidly expanding program required decentralized field control. Most of the early contracts within the continental United States were for work at existing Navy yards and bases or for several large Naval air stations. The Public Works Officers at those places usually were designated Officers-in-Charge of Construction. As their work expanded, they delegated the work to Resident Officers-in-Charge.

The appointment of an Officer-in-Charge followed the letting of the contract. From that time on he was in full charge in the field. His technical liaison with the Bureau was through the Bureau Project Manager, in the Construction Department, who forwarded plans, issued fund allotments, and handled general and technical problems. These Bureau Project Managers are essentially specialists. One is in charge of drydocks, another aviation, another hospitals, another personnel structures, etc. To coordinate different types of work, when two or more Project Managers are involved in work executed under a single contract, a Primary Project Manager is designated, and his job is to tie the ends of the work together in the Bureau.

On December 1, 1941, the Bureau of Yards and Docks, in Washington, D.C., was reorganized into five departments: (1) Planning and Design, (2) Construction, (3) Progress Control and Statistical, (4) Financial and Operation, and (5) Administrative and Personnel. These departments were divided into divisions and sections. The organizations of the Bureau, and of a typical office of an Officer-in-Charge, are shown in Figs. 1 and 2.

These five departments maintain direct contact with the field in their respective duties. Administrative and control procedures generally are prepared by those divisions and sections directly concerned. The work of the Planning and Design Department generally is cordinated with the Officers-in-Charge hrough the Bureau Project Managers. Allotment of funds, primarily controlled y the Finance and Operating Department, is also made through, and with the approval of, the Project Managers. The big job of the Administrative and Personnel Department is in recruiting the necessary Naval and civilian personnel to man the Navy's end of the work, both in the Bureau and in the field. Many civilian employees were, however, employed by the Officer-in-Charge and Resident Officers-in-Charge locally. The Progress Control and Statistical Department is a direct outgrowth of the fixed-fee type of contract. To this department fell the responsibility for the development of procedures and control over priorities of material, accounting and auditing, equipment rentals, forecasting of requirements for construction materials, statistics, and so forth.

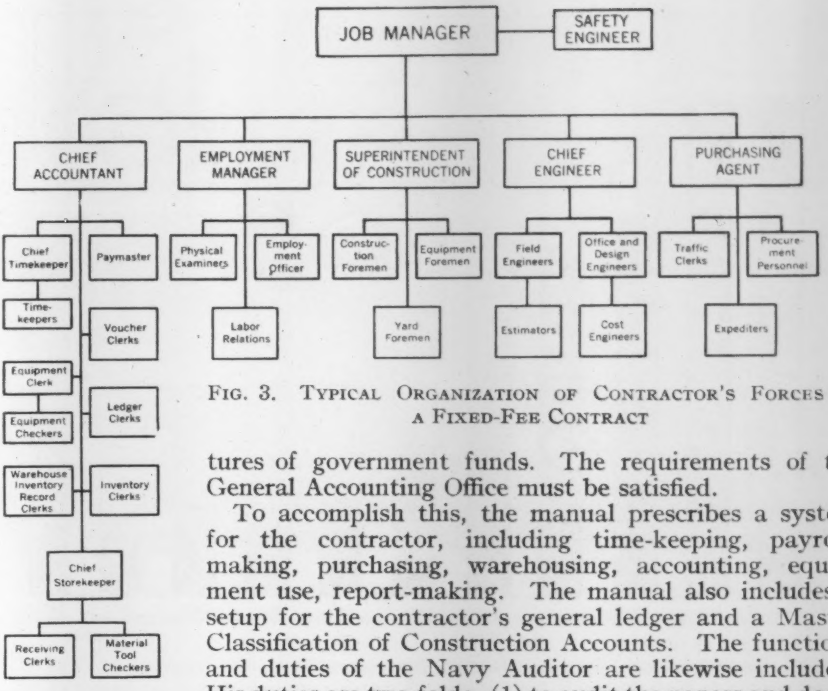


Fig. 3. Typical Organization of Contractor's Forces on a Fixed-Fee Contract

ADMINISTRATION AND CONTROL

It was apparent that some sort of general guidance and control over the administration of contracts was necessary. Many problems arose. For example, it was necessary properly to account for expenditures of public funds; to establish standards for labor and personnel relations; to provide for the expeditious purchase and delivery of material. Taxes, insurance, and freight problems had to be solved. Surplus material and equipment had to be moved to other jobs where it often was urgently needed to complete rush work. Certain reports were necessary. Information and instructions on all these subjects and many more had to be got into the field, to the Officer-in-Charge of Construction and to the contractor. To establish consistency in administrative procedures in the field, to instruct regarding requirements, and to simplify and assure uniform distribution of costs, a "Manual for Accounting, Auditing and Control of Negotiated Cost-Plus-a-Fixed-Fee Contracts" was prepared and issued to the field. Bureau "Circular Letters" became the medium for the distribution of current instructions and directives to the field.

This "Manual," as it is usually referred to, lays the groundwork for a typical organization. Chart No. 3 from the manual (the accompanying Fig. 3) shows a typical contractor's organization for a large contract. The manual establishes the principles for the administration of the contract, both by the Officer-in-Charge and the contractor. In the appendix are reproductions of standard forms for use, by the contractor and the Navy. These forms were printed in the Government Printing Office and stocked in the Bureau for issuance to the field.

As the tempo of work increased, and the need for speed and more speed became apparent in 1941, every ounce of unnecessary paper work was eliminated, thereby releasing manpower for direct productive work. Desirable and usual commercial and governmental procedures were eliminated if not absolutely necessary.

The requirements of the manual and supplemental directives are based on the fundamental fact that the expenditures involved are public funds. Meticulous care is taken to insure that all payments are correct. There must be an accounting for every dollar spent. Government accounting and disbursing officers are held to strict accountability and are personally liable for expenditures of government funds. The requirements of the General Accounting Office must be satisfied.

To accomplish this, the manual prescribes a system for the contractor, including time-keeping, payroll-making, purchasing, warehousing, accounting, equipment use, report-making. The manual also includes a setup for the contractor's general ledger and a Master Classification of Construction Accounts. The functions and duties of the Navy Auditor are likewise included. His duties are two-fold: (1) to audit the papers and documents submitted by the contractor for reimbursement, and (2) to maintain the appropriation records. He also maintains a close working relationship with the contractor's staff to see that Bureau requirements are fulfilled. He reports directly to the Officer-in-Charge, (or the Resident Officer-in-Charge, as the case may be) and is, so far as the auditing work is concerned, the right-hand man of these officers.

Control of labor in the field and the purchase of materials is the contractor's responsibility. It is his obligation to secure the best performance from his men, to purchase economically, to make the best use of materials and supplies, and to devise ways and means of constructing and operating as efficiently and as economically as possible. The Navy expects him to function as well as if he had a lump-sum contract. He is paid, through his fee, for his personal service, his technical knowledge, his going organization, his ability, his ingenuity, his financing costs, and his home-office overhead. The fee is not comparatively large on a percentage basis, but he faces no financial hazards. If his financial dealings are sound and his home-office overhead reasonable, his net fee results in a fair return for his services.

COMPENSATION FOR THE CONTRACTOR

Under the terms of the fixed-fee contract, the contractor is reimbursed for all out-of-pocket expenditures going directly into the work but not including "home-office" expense, financing costs and salaries, and travel expense of officers or partners of the contractor's firm. Neither is the contractor to be reimbursed for loss or damage due to his gross carelessness or negligence. The delineation between the cost of the work and home-office expense is so clear that it has not usually been difficult to agree as to which expenditures are reimbursable and which are not. This is so because contractor purchasing, accounting, and design are done in the field, and all generally are reimbursable, as well as construction payrolls, material and supply purchases, rentals, necessary insurance and taxes, services such as power, water, travel of employees in connection with the contract work, and so forth. The contracts provide that wage scales for craftsmen and laborers must be those established by the De-

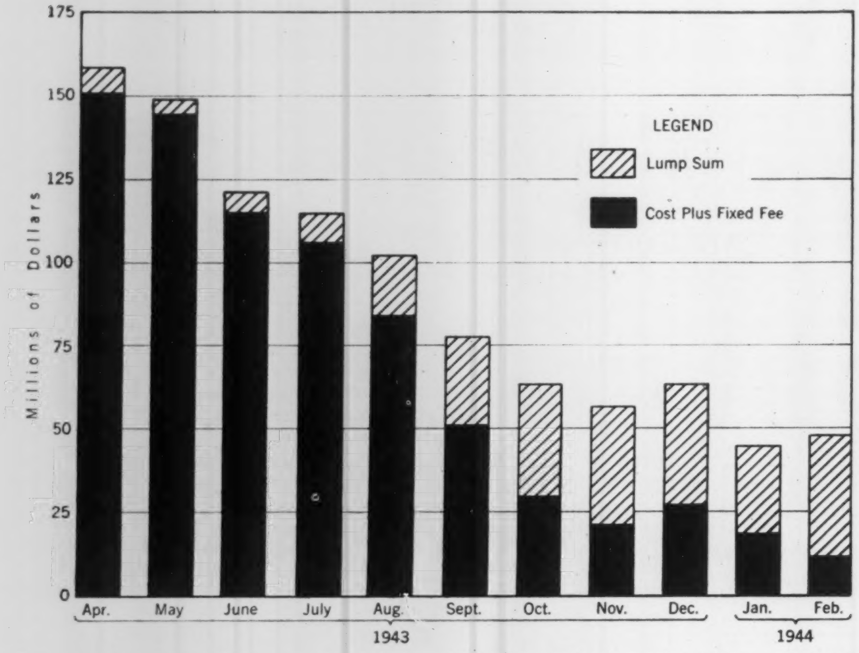


FIG. 4. EXPENDITURES, APRIL 1943 TO FEBRUARY 1944, BY BUREAU OF YARDS AND DOCKS ON FIXED-FEE CONTRACTS, EXCLUSIVE OF ADVANCE BASES

partment of Labor. Wage scales are included in the contract as an appendix.

In preparing the administrative and accounting procedures, simple, basic fundamentals were kept in mind. These are that, in reimbursing the contractor for costs, the Navy must be assured that (1) the contractor has actually spent the money, and that (2) he has received, for the Government, the material or service he paid for. Upon delivery to the contractor, all material, plant, equipment, and supplies immediately become the property of the Government. In receiving these, the contractor acts as agent for the Government.

In policy and in practice, the Officers-in-Charge and the Bureau set, and have maintained, an admirable record of reimbursing the contractor for his expenditures. Public vouchers, reimbursing the contractors, are generally prepared weekly and include reimbursement for all expenditures for which receipted invoices and other necessary papers are submitted. The net amount of the current payrolls, after deduction for social security, victory taxes, etc., are included in the public voucher immediately after payday. The social security and victory taxes are reimbursed to the contractor after returns have been made to local, state, and federal authorities, upon presentation of receipts evidencing payment.

To accomplish this expeditious reimbursement to the contractor, the Bureau's auditing procedure, as prescribed in the Manual, provides a "preaudit" system, which is the establishment of an even, everyday flow of receipted invoices and supporting papers to the Navy Auditor. In this way both the contractor and the Navy maintain a steady flow of papers through their offices, eliminating peak loads and setting the stage each week for quick approval of the reimbursement request and the preparation of the public voucher.

The Bureau of Supplies and Accounts, the Navy's disbursing agent, has cooperated in quickly reimbursing the contractor. Generally, the contractors have reimbursement checks in their banks within a week after the public vouchers are mailed in the field by the Officers or Resident Officers-in-Charge. This fine record has been maintained consistently throughout the entire fixed-fee construction period, now largely drawing to a close, and has resulted in saving very substantial financing costs to contractors. These savings undoubtedly have been passed on to the Government in subsequent fixed-fee contracts, by causing contractors to be satisfied with lower fees.

The fixed-fee form of contract, so successful in hastening the completion of projects, has resulted in saving many millions of dollars of public funds. Even had it been possible to originate projects under lump-sum or unit-price contracts, which it was not, the many changes arising from war experience and the rapid expansion of original contracts would have been either impossible or tremendously costly. As it was, changes were accomplished at the direction of the Bureau and Officers-in-Charge immediately and almost overnight, without wasting time and effort in dickering over costs. Everyone was free to devote his entire effort to getting the work done. The work itself was conducive to getting good costs. Much of the work—most of it, in fact—was started and completed in the face of stiff time schedules, and sometimes an apparently impossible completion date had to be met. The men knew they must have the docks, training stations, and supply depots ready on time. The ships, the sailors, and the supplies were rolling in. The facilities had to be ready—and the engineers and the contractors weren't asked when the facilities would be ready—they were told by the Bureau when they must be ready.

GENERAL NEED FOR FIXED-FEE CONTRACTS IS OVER

This greatest of all construction eras passed through the usual changes. December 7, 1941, left its mark on the work as it did on every person and industry in the country. For work on advance Navy bases it became wise and necessary to have construction men with military standing. The Seabees were the answer. This new and now famous organization of engineers and construction men gradually took over the tasks formerly assigned to their civilian brothers. The industry can be proud of the accomplishments of its uniformed members at advance bases and on far-flung battle fronts.

So now, with the peak of the continental emergency construction period past (Fig. 4), the fixed-fee form of contract has largely served its purpose. That it will be used again, on emergency construction, there is no doubt. It is fundamentally sound for use under certain conditions.

The tremendous projects most urgently needed for the training and service of our armed forces are now completed, or nearly so. There is now more time to prepare plans and specifications; construction is somewhat simpler; labor and material costs are more stable; contracts are smaller. Accordingly, since early in 1943, the Chief of the Bureau has led the way toward the early termination of fixed-fee contracts. The trend is well exemplified by Fig. 4, which compares expenditures, by months, for lump-sum and fixed-fee contracts. The lump-sum and the unit-price contracts are coming into their own again.

(The preceding statements are not official and do not necessarily reflect the views of the Navy Department or of the Naval service at large.)

Shipshaw No. 2 Power House and Headblock
In Left Background Is Dam No. 4

The Shipshaw Hydroelectric Project, Canada

I. History of Saguenay River Power

By McNeely DuBose
Vice-President, Aluminum Company of Canada, Ltd., Arvida, Canada

COMPLETION of the Shipshaw Project has been one of Canada's major contributions to the war effort. At a cost of about $70,000,000, power comparable in amount to that generated at Boulder Dam has been made available. As is the case with all projects of this size, considerable preliminary work was necessary before actual construction could be undertaken. In this paper, the first in a series on the project, Mr. DuBose relates the history of Shipshaw from the date of conception to the date of completion. This article is printed through the cooperation of the Engineering Institute of Canada, being condensed from the more comprehensive treatment in its publication, "The Engineering Journal," for April 1944.

THE Shipshaw power development is situated on the Saguenay River, which in size and importance is the second of the tributaries of the St. Lawrence River. (See Fig. 1.) Some 30,000 sq miles of territory, mostly virgin forest, drain into Lake St. John, which lies in a great depression of the Laurentian highlands and covers an area of 400 sq miles (Fig. 1). From this natural reservoir, the Saguenay rushes 30 miles through rocky gorges, with a drop of 320 ft to tidewater. Thence to the St. Lawrence, the river is wide, deep, and majestic.

The Saguenay was explored in the early days of Canadian history and for many years was useful only as a highway—at first for trappers, and later for lumbermen and agriculturists. The report of the Commissioner of Lands, Forests, and Fisheries of the Province of Quebec for the year 1898 contained the first public discussion of the power possibilities of the river. The report estimated that 15,000 hp might be developed on the Grand Discharge at the outlet of Lake St. John, and the following year, C. E. Gauvin, Superintendent of Surveys for the Province of Quebec, estimated that 82,000 hp could be produced at Chute à Caron, further down the Saguenay.

With vision aroused no doubt by the engineering reports of 1898 and 1899, three men obtained grants from the Crown of the right to develop power on the Saguenay River. The first grant, made on February 5, 1900, was to T. L. Willson. It embraced that portion of the river between the head of Chute à Caron and tidewater at the mouth of the Shipshaw River. On June 22 of the same year, L. T. Haggin obtained the rights to the portion of the river from Lake St. John to below Isle Maligne. And on the same day, B. A. Scott secured the rights in the portion of the river lying between the grant to Haggin and the grant to Willson. Roughly, each of these grants contained about one-third of the entire fall of the river.

The Government was glad to sell the power sites, for it wanted to promote the industrial prosperity of its people, and the grants provided for a forfeit if development were not promptly made. But as is so often the case, the power owners found that a power site in itself is no nearer to being a power plant than an egg is to being a hen; so in spite of their efforts to build or sell, many years passed with no progress. They had the vision, but the financing was beyond them.

It was not until 1913 that a move was made. In that year J. B. Duke, a financier interested in hydroelectric power development in the South, and then on a quest for a large power site for the production of nitrogen for fertilizer manufacture, was persuaded by Mr. Willson to visit the Saguenay accompanied by W. S. Lee, M. Am. Soc. C.E., the engineer from Charlotte, N.C., who had originally interested Mr. Duke in hydroelectric power. The sight was so impressive that he immediately purchased the power rights on the lower one-third of the Grand Discharge from Mr. Willson, and also the rights to the middle and upper thirds from their then-owners, for in the meantime they had changed hands.

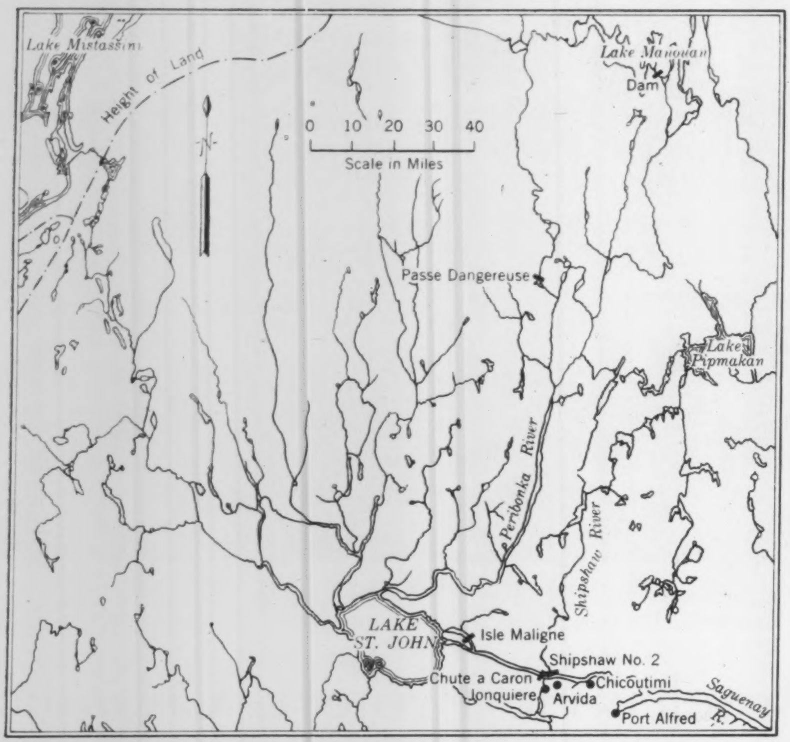


FIG. 1. WATERSHED OF LAKE ST. JOHN AND THE SAGUENAY RIVER

Then came the period of preliminary design. Mr. Lee sent F. H. Cothran, M. Am. Soc. C.E., in 1914, to make a detailed survey of the hydraulic possibilities of the power sites on the Saguenay. The power possibilities of the Grand Discharge were divided into two developments. One site was at Isle Maligne, near Lake St. John, where its dams would serve to utilize Lake St. John as a storage basin; the other site would concentrate the remaining 210 ft of head close to tidewater at the mouth of the Shipshaw River.

While Mr. Cothran was surveying the power sites, the Quebec Streams Commission, under O. O. Lefebvre, M. Am. Soc. C.E., chief engineer, had a survey of Lake St. John made by Huet Massue, to determine exactly its possibilities as a storage reservoir and the area of lands to be flooded for different heights of the regulated surface. The findings were given in the Commission's Fourth Report, dated November 1915. This report commented on what was at that time considered a serious question, namely, would the greater amount of ice in Lake St. John, caused by the lake freezing at a higher level with a greater expanse, delay the coming of spring and adversely affect farming? The report said "no."

By that time the First World War had commenced, which naturally was a deterrent to starting construction. Moreover, rights had not yet been obtained from the Quebec Government to build dams at the outlet of Lake St. John. The delay was due to the fear of uncontrollable flooding of farm lands. And, last but not least, Mr. Duke's experiments to perfect a nitrogen fixation process had not worked out satisfactorily and Mr. Duke found himself without a market for the power to be produced.

POWER FOR THE MANUFACTURE OF ALUMINUM

But Mr. Duke was a man of ideas. For years he had watched the growing uses of aluminum. He had seen the need for electric power to produce aluminum to blaze the trail of hydroelectric development from Niagara Falls to Cedar Rapids on the St. Lawrence, to Shawinigan Falls on the St. Maurice, and he felt that aluminum would be the answer to his quest for a mark for power from the Saguenay. So, with h partner, Sir William Price, who had agreed use temporarily 200,000 hp from the new d velopment for paper-mill operation and stea generation, he started construction work at th Isle Maligne site, which must necessarily b built first to provide storage for itself and th lower site near Shipshaw. This work was a nounced on December 18, 1922, twenty-tw years after the power rights were granted.

The Isle Maligne Power House has no plac in the history of the Shipshaw power develop ment, but the hydraulic works, that is, the roc excavation in the bed of the Grand Discharg at the outlet to Lake St. John to pass mor water at low lake levels, the earth dam an concrete power-house bulkhead, and the seve concrete spillways—all these were in effect com ponent parts of, and necessary to, the secon development to be made at Shipshaw. Five o the spillways were equipped with Stoney-typ sluice gates to control Lake St. John at eleva tions varying between $-\ 2^{1}/_{2}$ and $+\ 17^{1}/_{2}$ i order to provide a regulated discharge of 30,00 cu ft per sec and a calculated maximum dis charge capacity of 469,000 cu ft per sec wit the water at elevation $17^{1}/_{2}$ at the spillways The obligation to maintain and operate thes works for the benefit of the Shipshaw development was established as a servitude in favor of the Shipshaw power site. Construction of the Isle Maligne projec was completed in 1926.

Before the job at Isle Maligne was completed, o April 17, 1925, plans were deposited with the Quebec Government by Mr. Lee for the construction of the second power development on the Saguenay, to be called the Shipshaw development. The application accompanying the plans described the development as located on the Saguenay River near the mouth of the Shipshaw River. The works would consist of a concrete masonry dam and bulkhead across the Saguenay at or near Chute à Caron, and a canal of rock and earth excavation with earth dams along the same extending to an intake and a power house near the mouth of the Shipshaw. The contemplated regulated flow of the river was said to be 22,000 cu ft per sec, and it was anticipated that 440,000 hp would be available continuously. The power house would ultimately contain ten generating units of 80,000-hp capacity each, but only three would be initially installed. The approximate cost of the completed works was estimated to be 20 million dollars.

Preliminary construction for the Shipshaw project was actually started in 1926, but little progress was made for a couple of years. However, in 1928, in the optimistic atmosphere of a growing business boom, the Shipshaw development got under way in earnest.

A revision in the plans provided that the concrete dam across the Saguenay River just above Chute à Caron would be fitted with 11 Stoney-type sluice gates and a free spillway section and could, in emergency, discharge up to 600,000 cu ft per sec. Two power houses would be provided instead of one. The No. 1 power house would be located in the main dam across the river, called No. 1 Dam, and would contain four 65,000-hp generating units, enough to use about half of the regulated river flow. The head at the No. 1 power house, sometimes called the Chute à Caron power house because of its proximity to Chute à Caron, would be only three-fourths as great as the head at the No. 2 power house located on the Shipshaw River, t it had the advantage that it could mmence operation as soon as the st dam was completed and provide wer during the years foreseen to be quired for the completion of the canal d other works necessary for the No. 2 wer house. The intention was to ntinue right along with the construction of the No. 2 power house at an installed capacity of 800,000 hp.

By that time, experience indicated at Lake St. John could provide a gulated flow of 30,000 cu ft per sec stead of the 22,000 originally contemlated, and the plan of operation was at when the No. 2 power house was mpleted, the generating units in the o. 1 power house, with its lower head, ould be used as spares and also would e used at times when high water in the ver would back up against the No. 2 power house and duce its output, and in like manner reduce the output of e upper development at Isle Maligne. In the summer ater would be plentiful, and the No. 1 plant, in spite f its lower head, could be efficiently used to maintain e expected firm output of 300,000 hp at Isle Maligne nd 600,000 hp at Shipshaw.

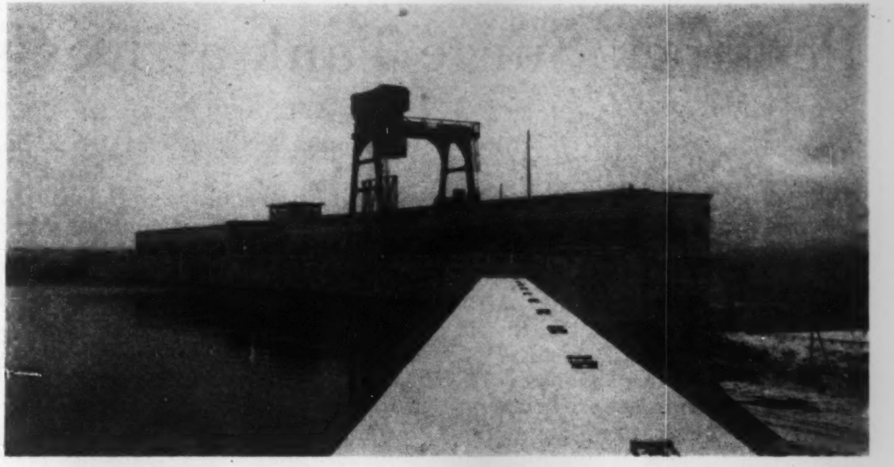
And then came 1930 and the depression. The demand r aluminum dropped to a point where no additional etal could be sold. An earth fill was thrown across the ntrance to the future canal and the construction of hipshaw was stopped when only the No. 1 dam across e Saguenay and the No. 1 power house had been completed. The canal with its component dams, and the o. 2 power house, had not even been started.

SHIPSHAW NO. 1 CONSTRUCTION

Nothing need be recorded, historically speaking, about he intial construction at Shipshaw No. 1, except the nique use of a pre-cast concrete dam 92 ft long, 40 ft eep, and 45 ft thick which was built on end and toppled nto the river to divert it from its natural bed into a reviously prepared by-pass canal, so that the concrete am across the Saguenay could be completed. (See "Blasting a Pre-Cast Dam Into Place," by C. P. Dunn, M. Am. Soc. C.E., CIVIL ENGINEERING, December 930.) For the second time, the first being a 100-ton last at Isle Maligne, heroic methods had to be resorted o, and by the use of this obelisk the Saguenay again contributed something new to engineering history.

But with construction over, Shipshaw's role for years was anything but heroic. From 1931 to 1938, the four nits of the No. 1 power house were used only to make power for steam generation, and half of the water in the river ran idly over the dam the year round. Then came the war. Immediately, the British Ministry of Supply wanted more aluminum, quickly. The power so fortunately available at Shipshaw was absorbed in aluminum production, and a need for even more power was foreseen by some.

Thoughts naturally turned to the completion of Shipshaw. The Aluminum Company of Canada, Ltd., began an engineering study under F. L. Lawton, of ways to develop economically an additional 100,000 hp or more, near Shipshaw No. 1 dam, where water was spilling the year round. By the beginning of 1940, when the plans for a diminished Shipshaw No. 2 plant had been worked out, it seemed possible that as much as 300,000 additional horsepower might soon be required. Aluminum Laboratories Ltd., an associated company specializing in engineering investigations, was employed to study the entire Shipshaw project and determine what improvements might be made in all previous designs.



POWER HOUSE FOREBAY WITH SOUTH WING WALL IN FOREGROUND

Aluminum Laboratories employed Stone and Webster to make this study, which resulted in a new plan for an undiminished Shipshaw. The Stone and Webster report had only just been received when need for still more aluminum became apparent. H. G. Acres, M. Am. Soc. C.E., was therefore employed in the fall of 1940 to make a complete review of the Shipshaw scheme and determine a final design which would produce a minimum of 250,000 hp and could be expanded to over 1,000,000 hp.

STORAGE AT LAKE MANOUAN AND PASSE DANGEREUSE

This increase in the contemplated size of the ultimate development was due to the growing demand for aluminum for war needs, which had already moved the aluminum Company of Canada to commence the construction of a water storage development at Lake Manouan, tributary to Lake St. John, which would increase the regulated flow of the Saguenay by 3,000 cu ft per sec or more. A survey was started to determine what would be the next most advantageous site for another storage dam if the demand for aluminum should increase so far as to make even more storage necessary. And a survey was planned to determine the possibility of diverting Lake Pipmaukan and the upper reaches of the Bersimis River into Lake St. John. So an eventual regulated flow of 50,000 cu ft per sec at Shipshaw had become a possibility. In July 1941, a storage reservoir at Passe Dangereuse, on the Peribonca River (Fig. 1), tributary to Lake St. John, was begun. This increases the regulated flow of the Saguenay by some 10,000 cu ft per sec, but so far no diversions have been made.

The story of the final construction of Shipshaw is hardly old enough to be called history. It should suffice to say that with the Foundation Company of Canada, Ltd., for contractors, and the wholehearted cooperation of many Canadian manufacturers, the time schedule, impossible though it seemed, was met, and on November 20, 1943, construction culminated in the Saguenay's third spectacular engineering exploit, which was the opening of the tailrace to the river by an 83,000-lb dynamite shot under the rock plug which had held back the water while the power house site and tailrace were excavated in the dry. Five days later, the first two units were in operation. Today, with four units in the No. 1 power house and twelve units in the No. 2, Shipshaw delivers a firm output of 925,000 hp and can produce a maximum of 1,500,000 hp.

Penstock Surge Tank at Denison Hydro Plant

By A. L. ALIN, M. AM. SOC. C.E.

PRINCIPAL ENGINEER, U.S. ENGINEER OFFICE, OMAHA, NEBR.

WATER stored by Denison Dam flows through a penstock over one thousand feet long, to the turbine. The long conduit and the relatively high velocity of the flow made it imperative that a surge tank be installed in the line to avoid the effects of surge and water hammer. A restricted-orifice type of tank was selected. In his description of the tank, Mr. Alin calls attention to the unusual precautions taken to prevent concrete shrinkage and separation of the steel pipe from its concrete encasement.

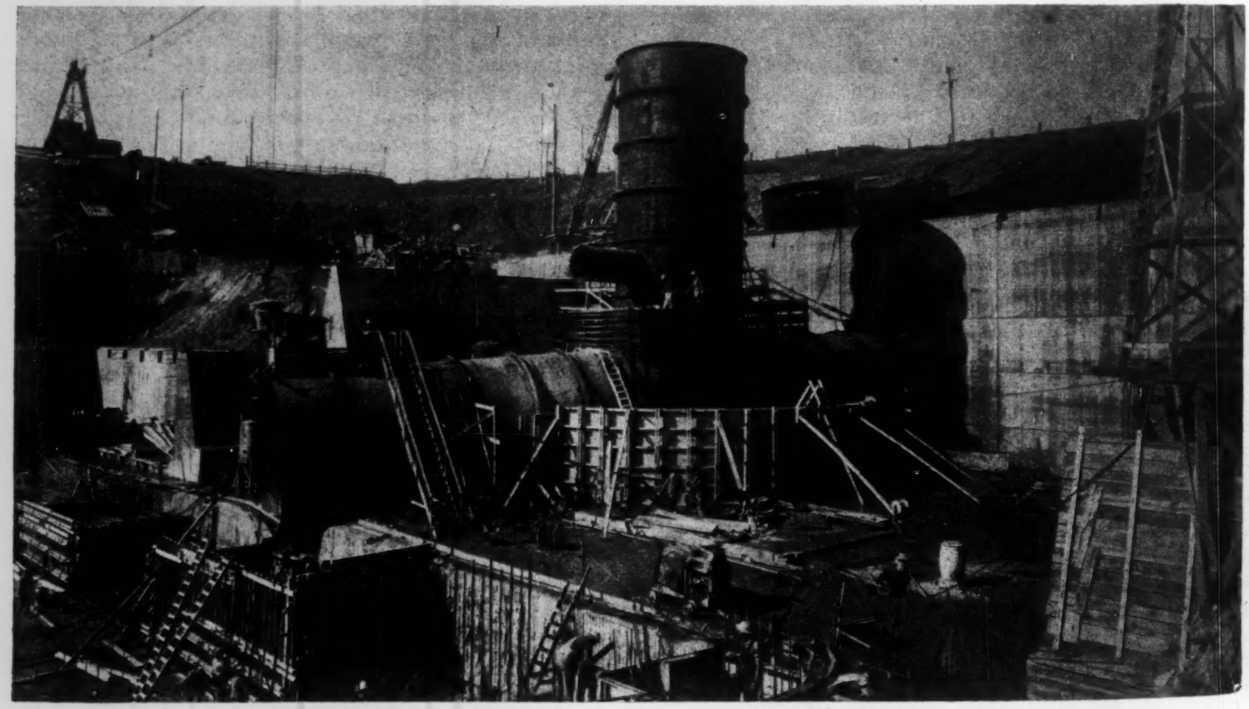
INSTALLATION of a surge tank for the hydroelectric unit at Denison Dam has recently been completed. The dam is built across the Red River, one of the principal tributaries of the Mississippi, 5 miles north of Denison, Tex., and 80 miles north of Dallas. The purposes of the project are flood control, power generation, navigation improvement, flow regulation, and other beneficial uses. Since the Red River at the site forms the boundary between Texas and Oklahoma, the dam is actually in both those states. The outlet works, power house, and spillway are on the right or Texas side. The principal features of the dam are the earth embankment, spillway, outlet works, and power house.

Of the rolled-fill type, the embankment has a maximum height of 165 ft, is about 3 miles long, and contains nearly 18 million cu yd of fill. The spillway is a huge concrete structure of the chute type, with an ungated crest 2,000 ft long and a converging chute paved to below tailwater elevation. Outlet works are adjacent to the original river and consist of 8 concrete conduits, each of 20-ft diameter. Flow through these tubes is controlled by gates in the control structure at the upstream toe of the embankment. Three of the conduits serve flood-control purposes and terminate in a stilling basin, and five serve power. The power conduits are steel lined.

The power house, of reinforced concrete, is at the downstream toe of the embankment on the land side of the stilling basin. Owing to wartime restrictions, only one unit has been installed at this time although the power house structure is built to accommodate two. There is a total o about 475,000 cu yd of concrete 16,000 tons of reinforcing steel, and 4,700 tons of structural steel of al types involved in all the structures Besides the dam, extensive work has been executed in the reservoir involving railroad and highway relocations, moving of towns, and protection of a major oil field. The project was originally estimated at about 54 million dollars, and the total eventual cost will be substantially in agreement with that estimate. Work began late in 1939 and, except for the power house, the project was practically completed in February 1944.

The power unit now installed develops 56,000 hp at a $102^1/_2$-ft head (Fig. 1). The turbine output varies between 38,000 and 84,000 hp with a variation in head o from 75 to 131 ft. The length of the conduit supplying water to the No. 1 unit is approximately 1,040 ft from the trash racks at the intake to the scroll-case entrance. Because of the length of the conduit and the relatively high velocity, the use of a surge tank was imperative at this site.

After a comprehensive study of all applicable types the restricted-orifice type of surge tank was selected fo the installation. The selection was based on economy o materials and good performance at all reservoir levels. It was determined that the selected design would require



RISER CONNECTED TO PENSTOCK—REINFORCEMENT IN PLACE PRIOR TO CONCRETING

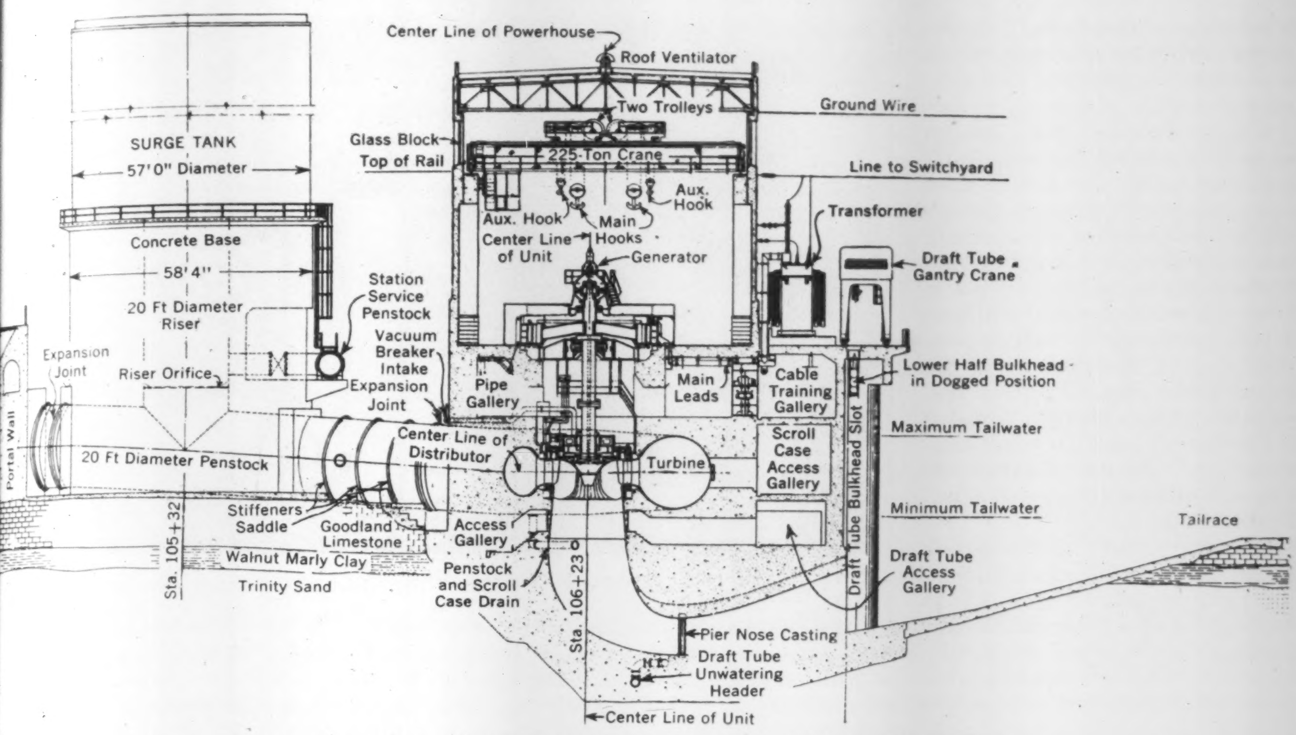

Center Line of Powerhouse
Roof Ventilator
Two Trolleys
Ground Wire
SURGE TANK
57'0" Diameter
Glass Block
Top of Rail
225-Ton Crane
Line to Switchyard
Aux. Hook
Main Hooks
Aux. Hook
Transformer
Center Line of Unit
Generator
Concrete Base
58'4"
Station Service Penstock
Draft Tube Gantry Crane
20 Ft Diameter Riser
Vacuum Breaker
Intake Expansion Joint
Expansion Joint
Riser Orifice
Pipe Gallery
Main Leads
Cable Training Gallery
Lower Half Bulkhead in Dogged Position
Portal Wall
Center Line of Distributor
Scroll Case Access Gallery
Maximum Tailwater
20 Ft Diameter Penstock
Turbine
Draft Tube Bulkhead Slot
Stiffeners
Saddle
Goodland Limestone
Access Gallery
Minimum Tailwater
Tailrace
Sta. 105+32
Walnut Marly Clay
Penstock and Scroll Case Drain
Sta. 106+23
Draft Tube Access Gallery
Trinity Sand
Pier Nose Casting
Draft Tube Unwatering Header
Center Line of Unit

FIG. 1. SECTION THROUGH DENISON POWER HOUSE, SHOWING SURGE TANK

somewhat less structural steel than other designs of equal hydraulic efficiency. Structural steel was a very critical material at the time the power house was planned.

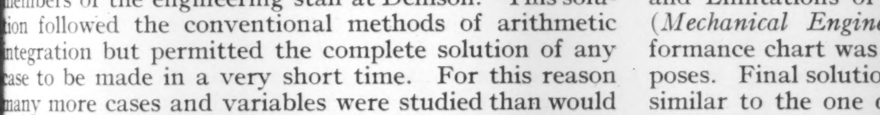
The first approach to the surge-tank design was made by considering the surge and water-hammer phases separately. After the preliminary design was complete, check computations were made to determine the complete hydraulic transients, including the simultaneous effect of both factors.

The surge properties of the tank were studied by means of a graphical solution which had been developed by members of the engineering staff at Denison. This solution followed the conventional methods of arithmetic integration but permitted the complete solution of any case to be made in a very short time. For this reason many more cases and variables were studied than would have been feasible with ordinary methods in the time available. The operation of the tank was studied under approximately 80 sets of conditions, including variations of type, orifice size and properties, effect of governor time, variations in reservoir elevations, acceleration under full gate conditions, and governing stability. The methods of study were checked against the conventional methods of arithmetic integration and were applied as a test to another tank for which both computations and a hydraulic model study were available.

Basic water-hammer studies were made according to the classic theory, particularly as expounded by R. S. Quick, M. Am. Soc. C.E., in his paper, "Comparisons and Limitations of Various Water Hammer Theories" (*Mechanical Engineering*, May 15, 1927). His performance chart was especially useful for estimating purposes. Final solutions were made by a graphical method similar to the one described by Prof. R. W. Angus, in "Water Hammer Pressures in Compound and Branched Pipes" (TRANSACTIONS, Am. Soc. C.E., Vol. 104, 1939). A modification of the Angus diagram was developed by members of the engineering staff, whereby the effect of the surge could be incorporated in the water-hammer design. As a result of the computations, the following general dimensions of the surge tank were determined:

Diameter (inside)	57 ft
Height (flat bottom)	95 ft
Elevation of top (same as top of dam)	670 ft above mean sea level
Diameter of riser (same as penstock)	20 ft
Diameter of restricted orifice	16 ft 9 in.

The riser pipe extends about 45 ft above the top of the 20-ft penstock, and the orifice is 5 ft above the top of the penstock. The center line of the surge tank

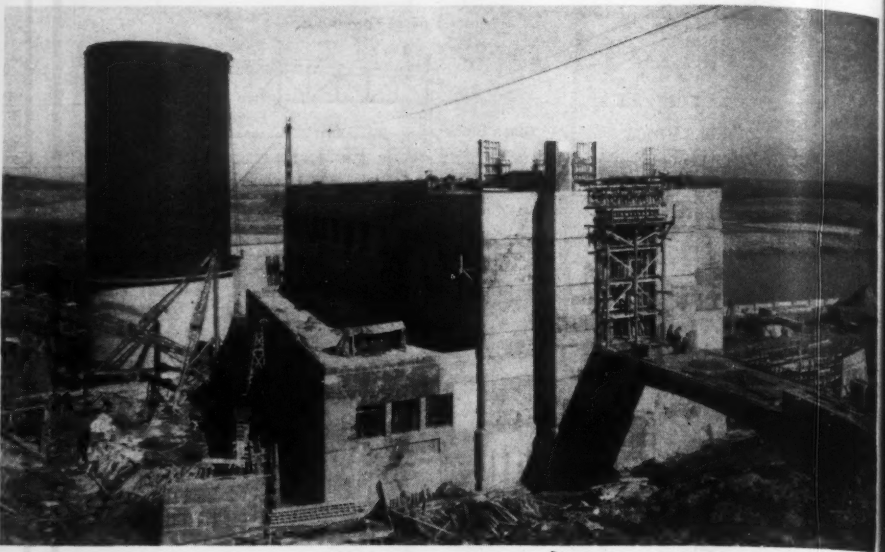


SURGE TANK AFTER CONCRETE ABOUT RISER HAD BEEN PLACED structure is about 78 ft from the turbine scrollcase entrance, which is as close as foundation conditions permit.

A concrete base 58 ft 4 in. in diameter supports the surge tank and surrounds the entire riser pipe and 59 ft of the penstock length. Selection of this concrete base instead of the conventional steel-column supports resulted in a direct saving of about 300 tons of structural steel as well as simplification of the design of the T-connection between riser and penstock, which in turn resulted in further elimination of critical materials. The use of a concrete base immediately suggested a flat-bottom tank.

Surge tank, riser, and penstock are all of welded design conforming to American Water Works Association and American Welding Society (1940 edition) standards. The steel work was fabricated and erected by the Chicago Bridge and Iron Company, under a contract separate from the power-house contract. The Chicago firm's contract included, in addition to the surge tank proper, that portion of the penstock located between the downstream toe of the embankment and the turbine scrollcase, a distance of about 115 ft. The rest of the penstock, from the intake to the downstream embankment toe, was erected under an earlier contract in connection with the construction of the outlet works.

The surge tank itself, 57 ft in diameter and 95 ft high, is built of plates varying from $^3/_8$ to $^3/_4$ in. in thickness and approximately 8 by 30 ft in other dimensions. These plates are connected by butt welds along both vertical and horizontal seams. The flat bottom of the tank is built of $^3/_8$-in. plates. The riser and the penstock, both 20 ft in diameter, are formed of welded $^3/_4$-in. plates.


COMPLETED SURGE TANK ADJACENT TO NEARLY COMPLETED POWER HOUSE

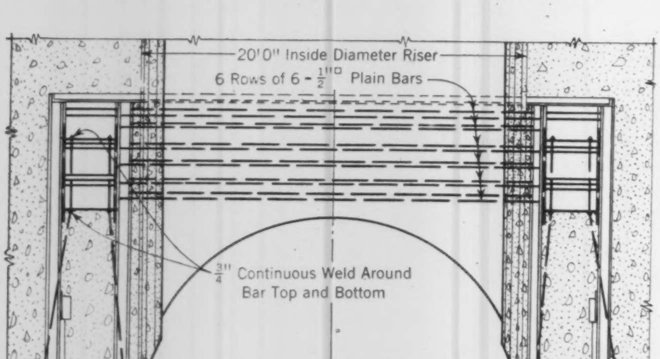

20'0" Inside Diameter Riser
6 Rows of 6 - $\frac{1}{2}$"□ Plain Bars
$\frac{3}{4}$" Continuous Weld Around Bar Top and Bottom
$1\frac{1}{2}$" Plain Bars @ 8" Center to Center
10'0" Radius (Inside)
$\frac{5}{8}$" Plate
6"
5'0"
4'0"
Rock Excavation
Limestone
6"
Anchors

FIG. 2. SECTION THROUGH CONNECTION OF SURGE TANK RISER TO PENSTOCK

Design of the T-connection between the riser and the penstock is most interesting and involves at least one novel feature. As previously stated, wartime restrictions made it desirable to eliminate as much structural steel and castings as possible. Of course, cement and reinforcing steel were also scarce but not to the same extent. It is believed that the solution found at Denison is unique and economical, involves a minimum of critical materials, and satisfies all the requirements of a safe design.

In a straight run of pipe, the metal forms complete circular hoops, the most efficient shape for resisting uniform internal pressure. At a T-connection this complete hoop shape is interrupted to permit flow into and from the stem pipe of the "T." As a result, some of the forces due to internal pressure from a 102-ft head (about 45 lb per sq in.) are not resisted by hoop tension. The conventional "T" for large pipes employs a system of castings or structural shapes to counteract these forces. It is not known that such a design has been executed for penstocks of a diameter as large as 20 ft. Several designs were considered, including the conventional steel "T" and steel columns supporting the surge tank, and also a combination reinforced-concrete and structural-steel "T" encased in a concrete base for the surge tank. The latter design (shown in Fig. 2) was finally adopted as meeting all the requirements of economy, safety, and wartime conditions.

Sixty-two horseshoe-shaped bars ($1^1/_2$ in. square on 8-in. centers), separated into two rows, enclose the penstock, with their ends extending about 6 ft above its top. The inner row is 6 in. from the lower half of the pipe, and the outer row is 2 to 5 ft beyond the inner row. At the top of the penstock, the bars are passed through holes in the webs of three 30-in., 300-lb, wide-flange beams, 32 ft long, on each side of the riser. These beams are parallel to the axis of the penstock. The 62 rods are welded to the upper surface of the top beam web and the lower surface of the bottom beam web. The ends of opposite beams are connected to each other across the top of the penstock by thirty-six $1^1/_2$-in. square bars on the upstream side of the riser, and the same number on its downstream side. These 72 bars are passed through, and welded to, the flanges of the 30-in. beams. The entire arrangement of bars and beams is supported by a light framework of structural shapes.

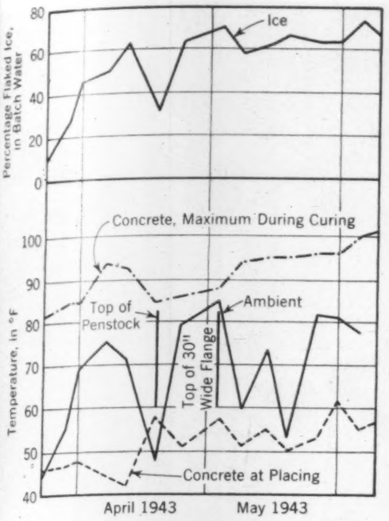


Fig. 3. Use of Ice in Concrete Mixing Water to Reduce Shrinkage

Vertical loads at the "T" pass directly from the penstock to the concrete and thence to the underlying stratum of lime stone. Horizontal loads are resisted by the semicylindrical reinforced-concrete frame formed by the 62 horseshoe bars. These bars and the bottom of the penstock furnish the area of steel needed for tension at the bottom of the penstock, and the separation of the two rows provides flexural resis tance. Across the top of the penstock the 72 bars upstream and downstream of the riser receive their loadfrom the horizontal 30-in. beams and provide the required tensile steel. While the exact action of the T-framing is of course indeterminate, partly because the entire T is enclosed in the concrete base for the surge tank, its general action is fairly simple.

CONCRETE SHRINKAGE LARGELY ELIMINATED BY THE USE OF FLAKED ICE

To avoid any separation of the steel pipe and the enclosing concrete, a pouring procedure was worked out for the base that tends to eliminate shrinkage of the concrete. This procedure involved the use of flaked ice (bought locally and trucked 5 miles to the job) as part of the mixing water, pouring of small heights (2 ft to 5 ft) of the base at one time, spraying the inside of the steel pipe with cool water, and requiring 90 hours to elapse between the completion of one pour and the beginning of the next. The proportion of mixing water in the form of flaked ice, the ambient temperature and the concrete temperature at placing and during curing, are shown in Fig. 3.

Construction of the penstock and T-connection was started on January 1, 1943, and completed on April 28, 1943. Concreting began on March 21, and was completed on June 9. The surge tank proper was erected during August and through October. Later the power equipment was tested preparatory to operation, and the plant began to generate power in June 1944.

The work in the Denison U.S. Engineer District was performed under the direction of Maj. E. J. Wanless, District Engineer. When the work here described was planned, Col. W. W. Wanamaker, M. Am. Soc. C.E., was District Engineer, and the writer was in charge of the Engineering Division. The hydraulic features of the surge tank were determined by R. S. Hornberger and John Herak, both with U.S. Indian Field Service and temporarily assigned to the U.S. Engineers during the design of the Denison power house. A. A. Brielmaier, Assoc. M. Am. Soc. C.E., of the Denison staff, designed the T-connection, and H. L. Johnson and Harold Kohler were responsible for construction and field inspection as Chief of the Operations Division and Resident Engineer, respectively.

The C. F. Lytle Company of Sioux City, Iowa, was the general contractor for the power house, including the concrete for the surge-tank base; and Chicago Bridge and Iron Company, of Chicago, Ill., was contractor for the steel work on penstock, riser, T-connection, and surge tank. During construction of the penstock and surge tank, A. F. Mathis was superintendent for the Lytle Company. The Chicago Bridge and Iron Company was represented at Denison by L. J. Weathers, as superintendent on erection of the penstock and T-connection, and R. R. Boatman on the surge tank proper.

Engineers' Notebook

Suggestions and Practical Data Useful in the Solution of a Variety of Engineering Problems

Servicing of Wartime Timber Structures

By Chester J. Hogue, M. Am. Soc. C.E.

In Charge, Technical Service, West Coast Lumbermen's Association, Seattle, Wash.

Engineers concerned with wartime wood construction, necessarily built of unseasoned lumber, are finding adequate servicing essential to satisfactory performance. When lumber is properly seasoned for the conditions of use, little servicing of timber structures is necessary. The urgency and magnitude of war demands for lumber do not permit time for seasoning before use in construction, however, and large amounts of unseasoned lumber have been used. Attention, consequently, must be given to servicing such structures until the lumber has become seasoned in place.

Servicing of timber-connectored structures built of unseasoned lumber is essential if costly repairs and replacements are to be avoided. The principal purpose of such servicing is to keep adjacent contact faces of connectored members in close contact. If this is done by tightening nuts on bolts as the lumber seasons in place, it is a simple operation. If it is neglected too long, repairs and replacements may have to be made.

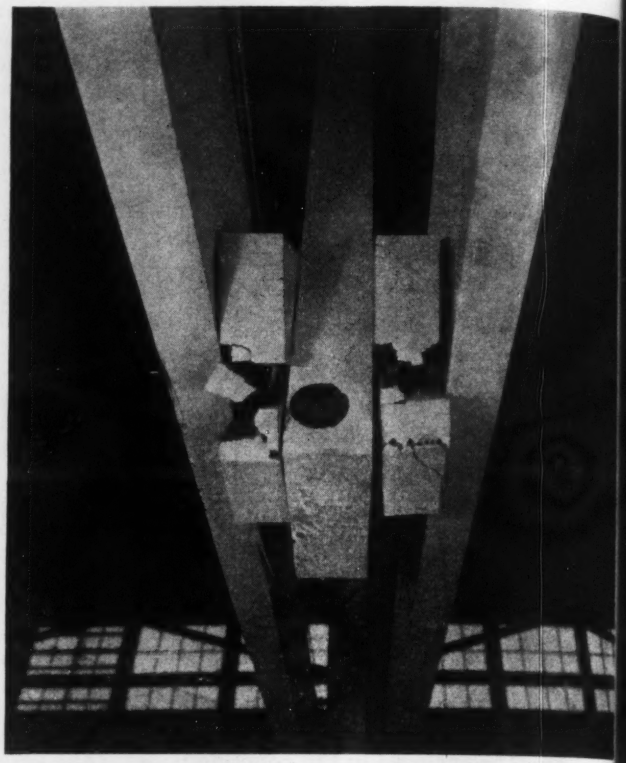
The published working loads for timber connectors are based on tests and recommendations by the Forest Products Laboratory. (See, "National Emergency Specifications for the Design, Fabrication and Erection of Stress Grade Lumber and Its Fastenings for Buildings," accompanying War Production Board Directive No. 29, Government Printing Office, Washington, D.C., price 15 cents; and "Design Manual for TECO Timber Connector Construction," Timber Engineering Company, 1319

Eighteenth St., N.W., Washington 6, D.C.) The recommended loads include reduction for connectors used in groups, and allowance for the various stresses in a joint in which the faces of adjacent members are kept in contact. When these faces become separate because of shrinkage, connectors are displaced, points of application of loads are changed, normal stress distribution is altered, intensities of stress are increased, and the joint no longer conforms to design assumptions. (See Fig. 1.)

THEORETICAL STRESS ANALYSES

Stress distribution in timber-connectored joints is complicated. Stress and strain distributions beyond the elastic limit are often uncertain and irregular. Any stress can be analyzed mathematically, but assumptions have to be made as a basis for any mathematical analysis, and with complicated stresses it is often difficult to develop assumptions of sufficient accuracy for exact mathematical calculation until the assumptions have been checked and corrected by test. Considerable progress has been made in the theoretical stress analysis of connector joints and in correlating the results with basic data on the mechanical properties of the wood and metal ("Timber-Connector Joints, Their Strength and Design," by John A. Scholten, Technical Bulletin No. 865, U.S. Department of Agriculture, Government Printing Office, Washington, D.C., price 20 cents), but the Forest Products Laboratory bases its design recommendations for connectors on actual tests. The tests made include all the factors involved, and a joint designed by using allowable loads determined from the tests will perform satisfactorily provided the faces are kept in contact. When adjacent faces of members in joints become separated, however, loads predicated on joints with faces kept in contact cannot be expected, nor is it practicable to make an assumption of the reduction in strength that may develop.

Wood adjusts its moisture content to a balance with the surrounding air. Such adjustment is accompanied by shrinkage in cross section, but not in length. The amount of shrinkage in a structure in use depends on the moisture content of the wood at the time of fabrication, and the temperature and humidity of the surrounding air.



Official U.S. Navy photograph (released)

EFFECT OF LACK OF SERVICING ON A STRUCTURAL JOINT

Moisture content in use may range from about 8% in a heated building to 12 or 14%, or even more, in an unheated building or in covered exterior use, depending on the average temperature and humidity of the locality. The total shrinkage will amount to somewhat more or less than a thirty-second of an inch per inch. In a very dry climate, the moisture content may become as low as 6%, and the shrinkage might be as much as three sixty-fourths of an inch per inch. Seasonal variations are normally so slight as to be unimportant after moisture-content balance has been reached.

The rate of seasoning also depends on the temperature and humidity of the surrounding air; the higher the temperature and the lower the humidity, the faster the drying. It depends, too, on the number of members meeting at a joint, and on the thickness of the members; the thicker a piece, the slower the drying. When drying is slow, servicing can be at longer intervals. With rapid drying, servicing should be given more prompt attention.

Structures built from unseasoned lumber should be inspected periodically for separation between adjacent members. When the air in which the trusses are in use is warm and dry, the first inspection should be made within a month after erection; under conditions of less rapid seasoning, a longer time can intervene, but it should not be more than three or four months. Nuts should be tightened on bolts when necessary, until the wood members have become thoroughly seasoned, in order to keep adjacent faces in contact.

In some instances the necessity for getting war structures in use speedily has resulted in the placing of heating units in the vicinity of unseasoned structural members immediately after erection. Rapid seasoning re-

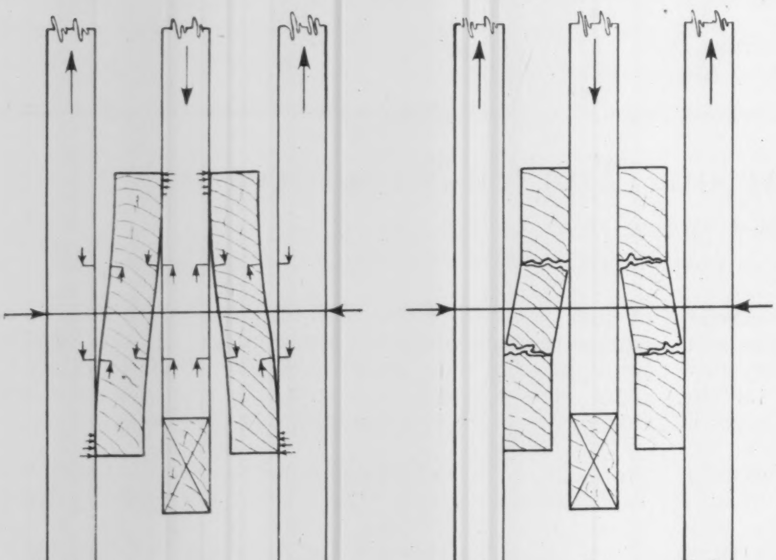


FIG. 1. DIAGRAMMATIC SKETCHES OF CONNECTOR JOINT WITH ADJACENT FACES SEPARATED, SHOWING (a) APPROXIMATE TYPE OF STRESSES INDUCED BY LOADING, AND (b) POSSIBLE RESULTING EFFECT ON MEMBERS

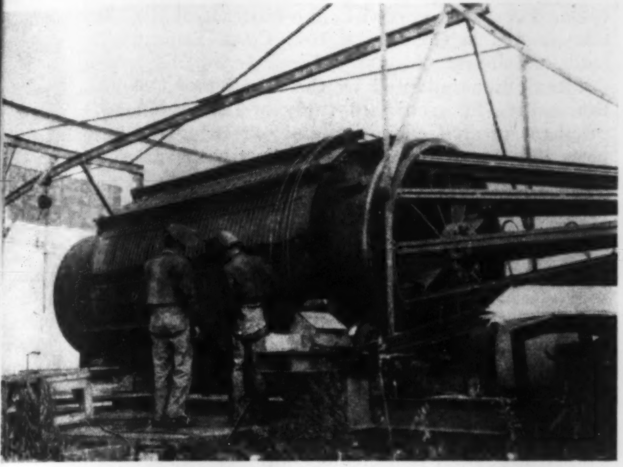
ulting from exposure to such hot, dry air results in inter- al stresses likely to cause unusual checking and splitting nless attention to servicing is given earlier than other- ise would be required.

When the faces of adjacent members become separated y shrinkage, members tend to rotate, and connectors become displaced. Unusual stresses are set up in the members, in addition to high stress concentrations at the reduced connector bearing areas. That is the cause of distress. Tightening of bolts keeps adjacent faces close together so that stresses will be normal and within safe working limits.

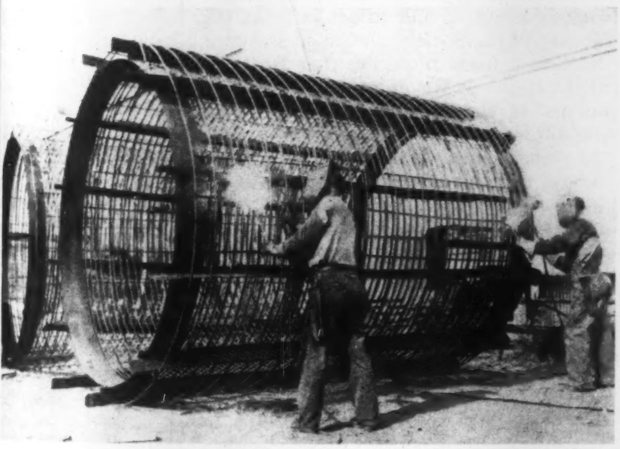
Winding and Welding Steel Cages for Reinforcement of Concrete Pipe

By William A. Shelton
American Concrete and Steel Pipe Company, Los Angeles, Calif.

FOR the circulating-water tunnels in the Harbor Steam Plant for the Department of Water and Power of the City of Los Angeles, Calif., steel pipe was first considered. But because of war conditions, it had to be abandoned in favor of steel-reinforced concrete pipe.



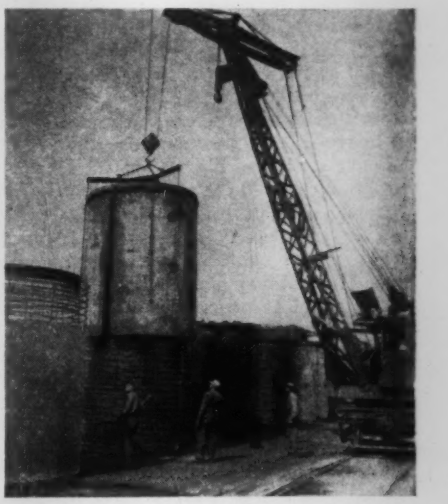
Reinforcing Steel Being Wound on a Mandrel



The Cage Was Then Welded Together

Tests have shown the concrete pipe to be 10% cheaper than steel pipe, and it had the additional advantages of much quicker delivery and probably longer life in sea water, besides the saving of essential war material.

In making the concrete pipe, one of the most important items was to prepare the steel cages used for reinforcing. These cages were made by first winding $^5/_8$-in. plain reinforcing steel on a mandrel and welding it to horizontal spacers; then the rod ends were welded together to additional $^1/_2$-in. horizontal spacers. Where welded bars were used for transverse reinforcement, each weld had to test to a stress of 40,000 lb per sq in. of bar.

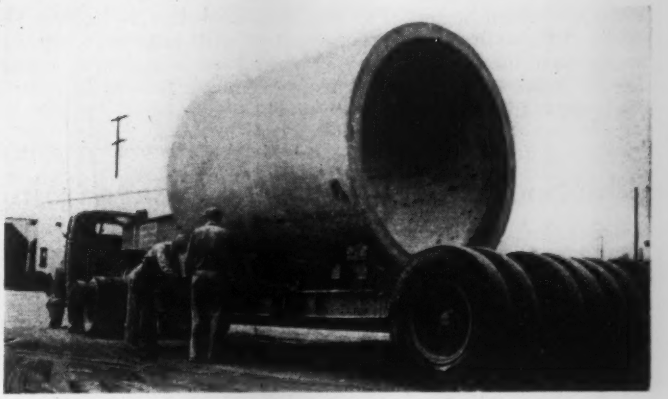


A Steel Form Being Placed Outside of a Reinforcing Cage

The forms in which the concrete pipe was cast consisted of an inner and outer steel form, a fabricated metal bottom ring, and a steel top ring. In preparation for pouring, a cage was lowered over the inside steel form, then the outside steel form was lowered over the cage and tightly closed. The inner and outer forms were welded of 8-gage sheet and were of sufficient thickness to prevent distortion when the concrete was poured. It was necessary that they be accurately made to the dimensions shown on the plans for the inner and outer diameters of the finished pipe—96 and 106 in., respectively. All plates had to fit together tightly to prevent leakage of mortar while the pipe was being cast and vibrated.

Altogether, 4,976 lin ft of this steel-reinforced concrete pipe was made and laid at a total cost of $211,480. In making the cages, 491 tons of reinforcing steel rods and bars were used, these alone costing $30,636.

(*This was a prize-winning article in the Hobart Arc Welding News Contest conducted by the Hobart Brothers Company, of Troy, Ohio, who furnished the photographs here included.*)



A Section of Completed Pipe

OUR READERS SAY—

In Comment on Papers, Society Affairs, and Related Professional Interests

"Interpretations" of Collective Bargaining

Dear Sir: In the May issue of Civil Engineering, the Committee on Employment Conditions submits what purports to be certain "interpretations" of its original proposal regarding collective bargaining. If I correctly construe the meaning of the four recommendations now presented by the Committee, especially when read in connection with the further supplementary suggestions accompanying them, the word "interpretation" hardly seems appropriate for the purpose. Rather than serving to clarify the details of the original proposal, these latest modifications seem to present a substitute program differing very materially from the Committee's former recommendations.

In the original proposal, as submitted to the Local Sections, the Society itself was pledged to the supervision of the contemplated program through the agency of four regional officers, to the support of which an appropriation of $50,000 per year was to be contributed out of the Society's treasury. In addition, the Local Sections were expected to administer the operation of their own regional groups. It is now made clear that the only service to be rendered by the Society or its constituent Sections will be that of initiating the movement through the selection of temporary interim committees. These committees are to exercise the sole function of organizing collective bargaining groups which will thereafter become self-governed, self-administered, and self-financed, and which will be in all respects absolutely independent as to both authority and responsibility.

It is somewhat difficult to understand why, under such circumstances, it is necessary for the Sections to take any official action whatsoever. There has never existed any obstacle which would prevent voluntary action on the part of enthusiastic members of the several Sections who might wish to facilitate the creation of engineering bargaining units, and it would seem that all the essential requirements could be met quite as readily in that manner as by the procedure now suggested.

Compared with the ambitious pronouncements of last fall, the very meager program now contemplated can only remind one of the mountain that labored and brought forth a mouse.

At all events, this experience should impress upon the minds of future members of the Society's Board of Direction the danger of precipitate action in giving hasty approval to proposed radical departures from established policies without first submitting the matter to the membership for study, suggestion, and criticism.

Charles R. Gow, M. Am. Soc. C.E.

Cambridge, Mass.

Board Action Deliberate and Proper

Dear Sir: Although I differ basically with Colonel Gow in his views on current Society activities, as expressed in his letter to the editor, I think his arguments are stated with propriety, with the exception of the last paragraph, in which I feel he is entirely wrong. My extensive study of this whole problem of collective bargaining leads me to directly the opposite conclusions.

The last paragraph of Colonel Gow's letter is both a criticism of the Board of Direction and of Society publications. Ever since Civil Engineering was established, it has been standard practice that criticism of a Society policy should be accompanied in parallel by rejoinder in the nature of explanation, prepared by a representative of the Society unit criticized. Because of my membership on the Board and chairmanship of the Committee on Publications, the duty therefore falls on me.

Contrary to Colonel Gow's impression, action of the Board was not "hasty." The matter has been under varying degrees of consideration for nearly six years and Society members knew this—at least they did if they read Civil Engineering. In spite of this, protests from the membership were negligible, until after the Board had made its recommendations last October. In fact, in two instances the Board was urged by groups of members to do just what it has done.

One instance, recorded in the abstract of the 1942 Board's actions, noted in the March 1943 Civil Engineering, page 149, reads as follows:

"Resolutions adopted by the District of Columbia Local Section calling for continued study of the classification and salary problems of civil engineers, and proposing the formulation of a procedure capable of use as a collective bargaining agency, were received and thoroughly discussed, but without adoption of the actions as specifically recommended."

Similarly, Colonel Gow's statement that the membership was not kept advised is far from accurate. Beginning in 1938 there was a report on "Unionization." Subsequently, there appeared in Civil Engineering 25 articles, minutes, or items, up to November 1943 when the Board recommendations in question, taken at its Atlanta Meeting in October, were published. Some of these comments were general, but mostly they were records of the Board study or actions in relation to the general topic. Most decidedly, members were kept advised of the trends in the profession.

Moreover, the Board of Direction is the legally constituted administrative body of a membership corporation. Its members act as their respective consciences dictate, subject only to the majority expression of opinions. It is their duty to be studiously aware of what is going on and to act in what they believe to be the best interest of the Society and its members. I have found nothing in the Constitution requiring that Board action must be submitted to the members for approval. And it is evident that in the best interest of the Society and the profession the Board must take action on many matters without submitting them individually to the membership. This does not imply, however, that the Board fails to respond to members' opinions.

I have been a member of the Board for two and a half years and at the very first meeting I attended I found this matter of collective bargaining under study by my predecessors. It has been studied at each of the nine subsequent meetings and with almost unanimous agreement.

These are the reasons, in brief, why I take issue completely with Colonel Gow's final paragraph.

Scott B. Lilly, M. Am. Soc. C.E.
Director District 4 and Chairman,
Committee on Publications

Swarthmore, Pa.

The Society and Collective Bargaining

Dear Sir: I have been asked by several friends to express my opinion regarding the present commotion in the Society relative to its participation in the union activities of the War Labor Board.

After reading a number of carefully prepared arguments pro and con and with due appreciation of the sincerity and earnestness of the several authors, I am disposed to view the situation in a somewhat lighter vein.

The almost one-hundred-year history of our Society shows that since it was organized numerous sporadic attempts have been made to divert its influence and energies to subjects wholly foreign to its purposes, generally involving political, wage, and general welfare interests of a portion of its members. However, these crises have been successfully passed, and we remain the outstanding engineering society of this country devoted to purely professional objectives. It is to be hoped that we will remain secure in this position, for it is my strong belief that when we depart from our present course gradual disintegration will necessarily follow. Therefore, I trust that the present labor agitation will not prevail and, failing in this, I earnestly hope that the matter may soon blow over, leaving us on our steady course as professional engineers.

I favor a referendum of the subject to the corporate members of the Society for letter ballot and am surprised that request for such action was recently denied by the Board. Is it possible that some of the members of a fleeting Board of Direction can be taking themselves rather too seriously when they assume that they know better what is good for the Society than do the members themselves?

I cannot but hope that the Board will see fit to reconsider its action of denial. To me, it seems undemocratic, to say the least.

Herbert S. Crocker, Past President and
Hon. M. Am. Soc. C.E.

Denver, Colo.

Unity Plus Cooperation

Dear Sir: In his letter, published on page 261 of Civil Engineering for June, Paul Benton, M. Am. Soc. C.E., not only clearly summarizes a bad situation but voices a challenge to the entire profession—effective unification. My experience and observation bear out the accuracy of his views.

We are all engineers primarily instead of members of particular subgroups of the engineering profession. I am particularly sensitive about this situation because I was born of a Northern mother and a Southern father in the area most hotly contested in our Civil War. I am sure we must have national unity, though some of our politicians seem to think otherwise. So does Herr Hitler!

Illustrating this same point—I have served in four different branches of the Army and know that, though each is necessary, none by itself wins a war. Cooperation is what counts. In order to succeed we must strive for a unity similar to that of our armed forces.

As a construction engineer, I have been plagued by the jurisdictional disputes of various unions. Why cannot we present a united front and make our voice heard publicly as a united profession? I am sure our light is being hid under a bushel.

One other personal experience! During the interim between wars I was active in several military societies which did great work in helping put this nation in the enviable position in which it stands today. Part of this work was pressure on Congress and part was public education. From our national leadership on down the line, I am sure very few laymen appreciate what our profession has done for the military effort or our peacetime economy. Mr. Benton has put his finger on the sore spot.

As members of the oldest of the engineering societies in this country, our influence should count heavily in the fight for effective cooperation.

Carroll D. Billmyer, Assoc. M. Am. Soc. C.E.

Kingston, R.I.

Professional Bargaining—Junior's Views

To the Editor: As a Junior I have been extremely interested in current articles on a professional engineer's bargaining agency. Most of the discussion, by older members, represents only one side of the problem, and I feel that the point of view of a younger member might be of interest.

Working on the staff of a consulting engineer, I do not fear that I personally will need the services of a bargaining agency for the more material possible gains. Few such professional engineering offices are so large that the personal touch is lost, and when one personally knows "the boss," one has no trouble in presenting his grievances. However, war conditions have changed the picture for a large number of engineers—that is, war plants employ engineers by the hundreds, so that the engineer has little opportunity for individual operation. I believe that this mass employment of engineers will continue well past the postwar reconstruction period, and so I am in favor of our own collective bargaining agency.

Referring to Mr. Furber's letter (June issue), most people associate the words "collective bargaining agency" with the idea of getting more money, and the popular method now seems to be by striking. I agree with Mr. Furber that it would be the height of folly even to think of using force or the threat of a strike for any gains. If that were to happen, every "professional" principle is gone forever. However, I feel that Mr. Furber brushed over one of his statements too quickly, when he stated, "Reliance on prestige might be like fighting empty-handed with an armed foe." Fight empty-handed we might, but in all good conscience, let's fight—fight for our rights where they have been denied, fight as our own group, and fight to keep our group separate. To ally with any other group would be as fatal as not fighting; in either case we become nonentities with the tag of employee hung on all of us.

As an engineer I have no desire to become associated with a tradesman's union for more money or for any other reason. On the contrary, I work for a more distinct separation. The current hubbub has been brewing for a long time, ever since engineers failed to distinguish between the engineer and the tradesman, something the doctor and the lawyer did not fail to do. The controversy has just now come to a focal point because of war conditions but, in my opinion, it was bound to come. The fact that we made this mistake in earlier years does not mean that we cannot correct it now. Now is as good a time as any to begin, and as good a way as any I can think of is to organize a professional engineer's agency or association similar to that which the doctors and the lawyers have.

True, we have the Society of which we are rightly proud, but nowhere do we find a collective agency to protect the engineer as a professional man. Personally, I believe that a bargaining agency —give it any name you like—should have a wider and longer view of the situation than just that of seeing to it that an engineer gets a fair salary and good working conditions. It should be organized to promote the professional standing of the engineer, to so widen the breach between the engineer and the tradesman that we become a group apart, neither members of management nor of labor, and can call ourselves truly professional. When that day comes, as it has in the past for the lawyer and the doctor, the engineer will no longer have to squabble about his salary or his working conditions.

Robert G. Dyktor, Jun. Am. Soc. C.E.

Saginaw, Mich.

Significance of Inter-Regional Highways to City Development

To the Editor: The system of inter-regional highways, referred to by Commissioner MacDonald in the May issue, is evidently intended to furnish direct highway access from center to center among the important cities of the country. The report of the National Inter-Regional Highway Committee points out that the system proposed connects directly all cities of 300,000 or more population, reaches 59 of the 62 cities with populations between 100,000 and 300,000, and has approximately 6% of its mileage within cities. From the standpoint of length of roadway, the city problem may appear to be minor, although the cost per mile in the urban areas would be much higher than in the rural areas.

Many other data in the report point to the importance of the cities as the origin and destination of traffic movement. The conclusion is therefore apparent that our major highways should not stop at the city limits as is usual today, but should be continued through the cities themselves, which is an objective contemplated for the inter-regional system. In most localities, especially where important bridge crossings are in the downtown sections, this means that the inter-regional routes must pass through the very centers of the cities. The question may then well be asked as to the influence of such traffic arteries upon the future of the cities themselves. Will they stabilize the centers of the cities, or will their effect be just the reverse?

The growing problem of expanding decentralization, mentioned by Mr. MacDonald, has accompanied the general use of the automobile; but many observers have concluded that it has been aided by inadequate access arteries to the center of the city. Inability to drive downtown quickly and with convenience has encouraged the desire to shop locally in suburban areas. Downtown department stores have established outlying branches in order to serve their trade. With present inadequate city traffic facilities, these trends may be expected to continue, at the decided expense of the economic welfare of the central city. But the opinion has been expressed, and apparently endorsed by retail tradesmen, that the provision of access arteries to the center of the city (with suitable terminal facilities) will cause the reversal of this trend and will result in retaining the major shopping district in the center of the city.

However, such traffic-ways operate in two directions, out of the city as well as into it. The same improved facility which will attract suburban and rural trade into the central city will also encourage residents to locate outside the central city. Such movement might speed up the decentralization which has been proceeding for some time. The arterial highways through a city cannot function like a check-valve, allowing trade to flow in but keeping population from flowing out. In this respect the inter-regional highway might be considered as inimical to the welfare of the cities.

As a deterrent to decentralization, the report suggests design for "denial of access" to the traffic-way between the traffic-generating-foci in the downtown portion of the city and the edge of the urban zone of traffic influence. The trend for population to spread outside the central cities has been with us for some time and has resulted from factors other than the inconvenience of local streets and highways. Serious as is this trend for the welfare of the cities, it cannot be reversed solely by features of the construction of the proposed new traffic-ways leading into the cities.

A more immediate control of the urban population probably lies in the ability of the cities to offer in-lying areas, which will be so attractive that people will choose to live in the cities, and will not feel attracted to suburban or rural areas. One important contribution to such rehabilitation would be the provision of a series of concentric street-routes across each city, so that local traffic can circulate more freely than is now possible in most localities. When the urban population is thus attracted to remain in the cities, then the inter-regional highways will become recognized for what they are intended—namely, improved traffic facilities between and into the cities. These traffic-ways should ultimately become a real boon to the welfare of the cities.

HARRY F. THOMSON, M. Am. Soc. C.E.
Vice-President, General Material Company

St. Louis, Mo.

Improvements in the City Planning Status

TO THE EDITOR: In the May issue Commissioner MacDonald, in his discussion of the inter-regional highway system as it affects cities, has given us his views on the need for planning in every community.

As I see it, there are three points of view on city planning. There are those who believe that no planning is necessary; others, like myself, who believe in what Commissioner Moses describes as "limited objectives" (planning projects which need to be done and which can be done with funds available or in sight); and the inevitable third group which believe that nothing should be done until a complete master plan has been approved and that this master plan should fit the national and even international program. It seems to me that the latter group is more interested in planning than in doing.

I thoroughly agree with Commissioner MacDonald's comment that one of the major reasons why planning bodies have been unsuccessful is that, "...as a rule [they] have not been made up of the officials of city government who are responsible for the actual construction of the projects involved" through the expenditure of public funds, and in his statement that, "it will surely be accepted that the man whose official position and public reputation are dependent upon his own performance of legally imposed responsibilities, must have an important part in planning the program which governs his use of public funds."

Since 1942 three of the six members of the New York City Planning Commission have been city officials with other responsibilities under the Charter. In that year the city administration apparently decided that the days of theoretical planning were over and that those of practical planning were to begin.

I cannot entirely agree with the commissioner's statements about zoning. We admit that the zoning done in the past has often been inadequate, and sometimes dictated by political expediency rather than sound zoning principles. However, it did a great deal to curb selfish ambitions of speculative builders and unscrupulous real estate operators. Chairman Salmon, of the New York City Planning Commission, has Commissioner Orton working on this problem now to correct many of the evils that still exist in the ordinance.

Zoning is young. It has progressed slowly but sensibly, and there is still time to correct many past errors. Modern industrial areas are now being planned so that they will be an asset to a neighborhood. Industrial slums with buildings occupying property fully and depressing values of adjacent blocks are shunned today because industrialists see the advantage of low buildings, low coverage, and pleasing designs.

Undoubtedly, as the commissioner says, many communities will find in the inter-regional highway system an opportunity to reshape portions of their city. However, I am afraid that in most cases cities will find that the choice of locations for these routes is limited. We cannot tear everything down and start over. We must deal with existing conditions and not with theories. We have billions of dollars invested in residential, business, and industrial property that cannot be scrapped.

However, the arterial highway system is the backbone of the city plan. It forms the framework upon which it seems safe to rebuild those portions of the community that need it. The establishment of parkways and other properly designed arterial highways has stabilized and increased values all over the city, but it must be followed by adequate zoning. Where this has been done the results have proved the sound economy of the expenditures.

Commissioner MacDonald's far-sighted policy of carrying inter-regional highways through communities has sounded the death knell of the practice of bringing highways to the city line and then leaving motorists to wend their way as best they can. As he states, in most communities finances will not permit the expenditures required to remedy the arterial problem completely. Recognition of the need for carrying these routes through cities was a long time coming, but now that it is here it is safe to say we are on the way toward the solution of many major traffic headaches.

GEORGE E. SPARGO, M. Am. Soc. C.E.

Forest Hills, N.Y.

Forum on Professional Relations

CONDUCTED COLUMN OF HYPOTHETICAL QUESTIONS WITH ANSWERS BY DR. MEAD

In the current issue Dr. Mead answers Question No. 22, which was announced in the May issue of "Civil Engineering." The question reads as follows: "A junior engineer not yet middle-aged has, as a result of some years of unsuccessful practice, been obliged to accept a position as draftsman in a large engineering firm and at a loss in salary. He has been promised advancement, but finds that invariably those who receive such advancement are agreeable fellows, whereas his temperament is such that he is kept in the position of draftsman at a salary hardly sufficient to meet the expenses of a growing family. How can he overcome this condition, which is discouraging and embittering him?"

Any man's position in life is necessarily due to opportunities and to his individual nature. The average day laborer lacks education, ambition, and in many cases native ability, and cannot reach a higher position unless he can overcome these handicaps, in part at least.

The young man in the case in question sees that advancement is made by men who are agreeable, while his own temperament is such that he remains a draftsman because of disagreeable traits that keep him from advancing. The only remedy for such a situation is for him to overcome his temperament and to cultivate the ability to get along with his colleagues and others. Self-control is always a difficult matter; nevertheless it can be cultivated and developed if there is sufficient will behind it.

Any man should study his own shortcomings and attempt to remedy them. Unless he is able to do this he must necessarily work under handicaps that limit him professionally and keep him from the position that he hopes to attain.

DANIEL W. MEAD, Past-President and
Hon. M. Am. Soc. C.E.

Madison, Wis.

Question No. 23, as given in the June issue, will be answered in the next, or August, issue. Next in the series the following question is announced. Replies may be received until August 5, with answers in the September issue.

QUESTION NO. 24: *A young engineer accepts a position with a practicing engineer whom he does not know very well. After a short time he discovers that his employer is dishonest, although he has never asked the young engineer to engage in any crooked action himself. Should the young engineer retain his job?*

Seventy-Fourth Annual Convention

Cleveland, Ohio—July 19–21, 1944

Hotel Cleveland to Be Headquarters

Opening Session and General Meeting

WEDNESDAY—July 19, 1944—Morning

9:00 **Registration on the Balcony**

10:00 **Convention called to order in the Ballroom by**

MARK SWISHER, *President, Cleveland Section, Am. Soc. C.E.*

10:05 **"America" by entire assembly**

10:10 **Addresses of Welcome**

HIS HONOR FRANK J. LAUSCHE, *Mayor of the City of Cleveland*

WARNER SEELY, *Secretary, Warner & Swasey Company*, Cleveland, Ohio.

10:35 **Response by**

MALCOLM PIRNIE, *President, American Society of Civil Engineers*

10:45 **Annual Address**

MALCOLM PIRNIE, *President, American Society of Civil Engineers*

11:25 **Business Meeting**

12:00 **Adjournment**

WEDNESDAY LUNCHEON FOR MEN

12:15 p.m., Red Room, Hotel Cleveland

At the close of the Wednesday morning session there will be a luncheon for members and men guests in the Red Room, Hotel Cleveland. Ladies will attend a special luncheon at Higbee Auditorium mentioned elsewhere in this program.

RICHARD E. DOUGHERTY, *M. Am. Soc. C.E.; Vice President, Improvements and Development, New York Central System*, will address the luncheon group on

"PROBLEMS OF THE RAILROADS IN THE POSTWAR PERIOD"

Tickets for the luncheon will be $1.75 each.

WEDNESDAY—July 19, 1944—Afternoon

FORUM ON POSTWAR CONSTRUCTION

2:00 p.m., Ballroom, Hotel Cleveland

G. DONALD KENNEDY, *M. Am. Soc. C.E.; Chairman, Society's Committee on Postwar Construction, Presiding*

This program has been prepared by the Society's Committee on Postwar Construction and is presented as part of the Society's contribution to a vitally needed coordinated effort to stimulate immediate preparations for postwar construction.

2:00 **Introductory statement**

G. DONALD KENNEDY, *M. Am. Soc. C.E.; Chairman, Society's Committee on Postwar Construction; Vice President, Automotive Safety Foundation*, Washington, D.C.

2:10 **The Place of Construction in the Postwar Economy**

ELMER L. LINDSETH, *Chairman, Cleveland Committee for Economic Development; Vice President, Cleveland Electric Illuminating Company*, Cleveland, Ohio

2:40 **Congressional Thinking Regarding Federal Participation in Postwar Construction**

THE HON. J. HARRY MCGREGOR, *Member of Congress, Representing 17th District of Ohio; Member, House Committee on Roads; Member, House Committee on Public Buildings and Grounds; Member, Subcommittee of Committee on Public Buildings and Grounds Studying Postwar Construction and Planning, Including Housing and Sale of Surplus Goods*, Washington, D.C.

3:10 **The Importance of Municipal Planning for Postwar Employment**

S. BURNS WESTON, *Executive Director, Postwar Planning Council of Greater Cleveland*, Cleveland, Ohio

3:40 **General discussion**

4:00 **Adjournment**

INFORMAL DINNER AND ADDRESS

WEDNESDAY—July 19, 1944—Evening

6:00 p.m. **Social hour in the Red Room, Hotel Cleveland**

7:00 p.m. **Dinner in the Ballroom**

MARK SWISHER, *President, Cleveland Section, Am. Soc. C.E., Presiding*

JAMES F. LINCOLN, *President, Lincoln Electric Company*, Cleveland, Ohio, will address members and guests on

"FREE ENTERPRISE OR GOVERNMENTAL FEUDALISM—WHICH?"

Dress—Informal Following the dinner and address there will be dancing until midnight. Tickets—$3.00

Sessions of Technical Divisions

THURSDAY—July 20, 1944—Morning

SANITARY ENGINEERING DIVISION

Red Room

George E. Barnes, *M. Am. Soc. C.E., Presiding*

9:30 Introductory remarks

George E. Barnes, *M. Am. Soc. C.E., Head, Dept. of Civil Engineering and Professor, Hydraulic and Sanitary Engineering, Case School of Applied Science,* Cleveland, Ohio

9:40 Observed Deficiencies in Water Supply Systems in Ohio

Frederick H. Waring, *M. Am. Soc. C.E., Chief Engineer, Division of Sanitary Engineering, State Dept. of Health,* Columbus, Ohio

10:20 Discussion by

Thomas R. Camp, *M. Am. Soc. C.E., Consulting Engineer,* Boston, Mass.

Earl Devendorf, *Assoc. M. Am. Soc. C.E., Assistant Director, Division of Sanitation, New York State Health Dept.,* Albany, N. Y.

F. Woodbury Jones, *Consulting Engineer, Havens and Emerson,* Cleveland, Ohio

10:50 Depletion and Recharge of Ground Water Supplies

E. J. Schaefer, *Associate Engineer, U.S. Geological Survey,* Columbus, Ohio

11:30 Discussion by

David H. Harker, *Engineer Chief of Staff, Ohio Water Supply Board,* Columbus, Ohio

11:40 General discussion

12:00 Adjournment

SOIL MECHANICS AND FOUNDATIONS DIVISION

Ballroom

Joel D. Justin, *Chairman, Executive Committee, Presiding*

9:30 Introductory remarks

Joel D. Justin, *M. Am. Soc. C.E., Consulting Engineer,* Philadelphia, Pa.

9:40 Some Ohio Foundations

Joseph R. Burkey, *M. Am. Soc. C.E., Consulting Engineer, Union Metal Mfg. Co.,* Canton, Ohio

10:25 Discussion by

James H. Herron, *M. Am. Soc. C.E., Pres., The James H. Herron Co.,* Cleveland, Ohio

H. E. Marshall, *Geologist, Ohio State Highway Department Laboratories, Ohio State University Campus,* Columbus, Ohio

10:45 Laboratory and Field Work on Earth-Fill Dams

Robert R. Philippe, *Assoc. M. Am. Soc. C.E., Senior Engr., U.S. Engineers,* Mariemont, Ohio

11:30 Discussion by

Glennon Gilboy, *Assoc. M. Am. Soc. C.E., Consulting Engineer,* South Lincoln, Mass.

Kenneth B. Woods, *M. Am. Soc. C.E., Assoc. Prof., Highway Eng., Purdue University,* West Lafayette, Ind.

11:50 General discussion

12:20 Adjournment

SURVEYING AND MAPPING DIVISION

Empire Room

Philip Kissam, *Chairman, Executive Committe Presiding*

9:30 Introductory remarks

Philip Kissam, *M. Am. Soc. C.E., Associate Professo Civil Engineering, Princeton University,* Princeton, N.J.

9:40 The Cleveland Regional Geodetic Survey

G. Brooks Earnest, *M. Am. Soc. C.E., Associate Pr fessor, Engineering Surveying, Case School of Applied Scienc* Cleveland, Ohio

10:20 Discussion by

Norman M. Wilke, *Engineer of Design, Ohio Sta Highway Department,* Cleveland, Ohio

Robert J. Edwards, *Assoc. M. Am. Soc. C.E., Civ Engineer, Cuyahoga County Engineers,* Cleveland, Ohio

10:40 A Practical Accuracy for Property Surveys

Sol A. Bauer, *Assoc. M. Am. Soc. C.E., Bauer Survey Company,* Cleveland, Ohio

11:20 Discussion by

A. P. Harness, Jr., *President, Jennings & Lawrenc Engineers,* Columbus, Ohio

11:30 General discussion

12:00 Adjournment

THURSDAY—July 20, 1944—Afternoon

SANITARY ENGINEERING DIVISION

Red Room

N. T. Veatch, Jr., *Member, Executive Committee, Presiding*

2:00 Introductory remarks

N. T. Veatch, Jr., *M. Am. Soc. C.E., Consulting Engi neer, Black and Veatch,* Kansas City, Mo.

2:10 Evaluation of Sewage Works Data

William L. Havens, *M. Am. Soc. C.E., Consulting Engi neer, Havens and Emerson,* Cleveland, Ohio, and

F. Woodbury Jones, *Consulting Engineer, Havens an Emerson,* Cleveland, Ohio

2:50 Discussion by

George E. Symons, *Assoc. M. Am. Soc. C.E., Associa Editor, "Water Works and Sewerage,"* New York, N.Y.

T. C. Schaetzle, *Superintendent of Sewage Treatmen* Akron, Ohio

3:15 Characteristics and Disposal of Trade Wastes from Co **polymer Synthetic Rubber Industry**

George E. Barnes, *M. Am. Soc. C.E., Head, Dept. o Civil Engineering and Professor, Hydraulic and Sanitar Engineering, Case School of Applied Science,* Clevelan Ohio (*Consultant, War Production Board*), and

Mathew M. Braidech, *Professor, Sanitary and Indus trial Chemistry, Case School of Applied Science,* Clevelan Ohio (*Consultant, War Production Board*)

3:55 Discussion by

Harold W. Streeter, *M. Am. Soc. C.E., Sanitary Eng neering Director, U.S. Public Health Service,* Cincinnat Ohio

4:10 General discussion

5:00 Adjournment

Sessions of Technical Divisions

THURSDAY—July 20, 1944—Afternoon

STRUCTURAL DIVISION

Ballroom

Charles A. Ellis, *Chairman, Executive Committee, Presiding*

2:00 **Introductory remarks**

Charles A. Ellis, *M. Am. Soc. C.E., Professor, Structural Engineering, Purdue University,* West Lafayette, Ind.

SYMPOSIUM ON THE BROOKLYN BRIDGE

2:03 **Historical Background and Features of Construction and Operation**

Homer R. Seely, *M. Am. Soc. C.E., Deputy Commissioner, Dept. of Public Works,* New York, N.Y.

2:33 **Design and Stress Condition**

O. H. Ammann, *M. Am. Soc. C.E., Consulting Engineer,* New York, N.Y.

3:13 **Physical Examination and Field Observations**

Nomer Gray, *Assoc. M. Am. Soc. C.E., Civil Engineer, Dept. of Public Works,* New York, N.Y.

3:43 **Tests of Materials in Cables and Stiffening Trusses**

Harold E. Wessman, *M. Am. Soc. C.E., Chairman, Dept. of Civil Engineering, New York University,* New York, N.Y.

4:03 Discussion

4:33 Adjournment

SURVEYING AND MAPPING DIVISION

Empire Room

G. Brooks Earnest. *Member, Executive Committee, Presiding*

:00 **Introductory remarks**

G. Brooks Earnest, *M. Am. Soc. C.E., Associate Professor, Engineering Surveying, Case School of Applied Science,* Cleveland, Ohio

:10 **Photogrammetry and the Civil Engineer**

Virgil Kauffman, *President, Aero Service Corp.,* Philadelphia, Pa.

:50 **Aerial and Ground Surveys and Maps for Highway and Related Land Development**

Wilbur H. Simonson, *Landscape Architect, Public Roads Administration,* Washington, D.C.

:30 **Discussion by**

William N. Brown, *M. Am. Soc. C.E., President W. N. Brown, Inc.,* Washington, D.C.

:40 **General discussion**

:30 **Adjournment**

FRIDAY—July 21, 1944—Morning

CITY PLANNING DIVISION

Red Room

John Nolen, Jr., *Chairman, Executive Committee, Presiding*

9:30 **Introductory remarks**

John Nolen, Jr., *Assoc. M. Am. Soc. C.E., Director of Planning, National Capitol Park and Planning Commission,* Washington, D.C.

9:40 **An Urban Redevelopment Program for Cleveland**

John T. Howard, *Planning Director, City Planning Commission,* Cleveland, Ohio

10:10 **Factual Basis for Cleveland's Program**

Howard W. Green, *M. Am. Soc. C.E., Director, Real Property Inventory of Metropolitan Cleveland,* Cleveland, Ohio

10:30 **Techniques of Redevelopment Planning**

Robert C. Weinberg, *Consultant,* New York, N.Y.

10:50 **General discussion**

11:10 **The Economic and Social Foundation of Community Planning**

M. C. Lubar, *Associate City Planning Analyst, City Plan Commission,* Detroit, Mich.

11:40 **General discussion**

12:00 **Adjournment**

CONSTRUCTION DIVISION

Ballroom

Clyde W. Wood, *Member, Executive Committee, Presiding*

9:30 **Introductory remarks**

Clyde W. Wood, *Assoc. M. Am. Soc. C.E., President, Metropolitan Construction Company,* Los Angeles, Calif.

9:40 **Fundamental Principles of Specifications**

Roger W. Armstrong, *M. Am. Soc. C.E., Deputy Chief Engineer, Board of Water Supply,* New York, N.Y.

10:10 **Construction Specifications and Contracts**

Rolf T. Retz, *Assoc. M. Am. Soc. C.E., Senior Civil Engineer, National Advisory Commission for Aeronautics,* Langley Field, Va.

10:40 **Discussion by**

Charles W. Jauch, *Secretary, Associated General Contractors of America,* Cleveland, Ohio

11:00 **General discussion**

12:00 **Adjournment**

INFORMAL DINNER AND ENTERTAINMENT

THURSDAY—July 20, 1944

7:00 p.m. Ballroom

On Thursday evening an informal dinner will be served in the Ballroom for all men and their ladies.

Thomas R. Agg, *M. Am. Soc. C.E., Dean of Engineering, Iowa State College, Presiding*

Following the dinner, a travelogue will be presented by C. N. Rakestraw. Mr. Rakestraw's subject, illustrated by color movies, will be

"SOUTH AMERICA—THE EAST COAST"

Tickets will be $3.00 each.

Sessions of Technical Divisions

FRIDAY—July 21, 1944—Morning

WATERWAYS DIVISION

Empire Room

WILLIAM G. ATWOOD, *Chairman, Executive Committee, Presiding*

9:30 Introductory remarks

WILLIAM G. ATWOOD, *M. Am. Soc. C.E., Consulting Engineer,* Winter Park, Fla.

9:40 One Hundred Years of the Lake Survey

PAUL S. REINECKE, *M. Am. Soc. C.E., Colonel, Corps of Engineers, U.S.A., District Engineer, U.S. Lake Survey Office,* Detroit, Mich.

10:15 Discussion by

LOUIS C. SABIN, *M. Am. Soc. C.E., Vice-President, Lake Carriers' Association,* Cleveland, Ohio

LEO O. COLBERT, *M. Am. Soc. C.E., Rear Admiral, Director, U.S. Coast and Geodetic Survey, Washington, D.C.*

10:35 Development of Loading and Unloading Devices for Bulk Freight Handling on the Great Lakes

A. E. GIBSON, *President, Wellman Engineering Company,* Cleveland, Ohio

11:10 Discussion by

WENDELL P. BROWN, *M. Am. Soc. C.E., Consulting Engineer,* Lakewood, Ohio

GEORGE H. HUTCHINSON, *M. Am. Soc. C.E., Pittsburgh and Ohio Valley Railroad,* Pittsburgh, Pa.

11:30 General discussion

12:00 Adjournment

FRIDAY—July 21, 1944—Afternoon

DISCUSSION OF REPORT OF THE NATIONAL ASSOCIATION OF RAILROAD AND UTILITY COMMISSIONERS' COMMITTEE ON DEPRECIATION

Red Room

EDGAR DOW GILMAN, *Chairman, Executive Committee, Engineering Economics Division, Presiding*

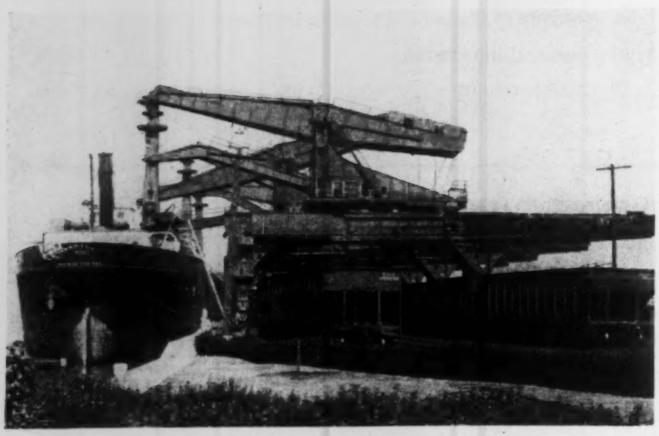
This program has been arranged under the auspices of the Engineering Economics Division

2:00 Introductory remarks

EDGAR DOW GILMAN, *M. Am. Soc. C.E., Director, Department of Public Works,* Cincinnati, Ohio

2:10 Report of American Society of Civil Engineers' Special Committee on Depreciation

THOMAS R. AGG, *M. Am. Soc. C.E., Dean of Engineering, Iowa State College,* Ames, Iowa



ELECTRIC ORE UNLOADERS AT WORK AT CLEVELAND

3:00 Discussion by

MALCOLM PIRNIE, *President, Am. Soc. C.E., Consultin Engineer,* New York, N.Y.

HENRY E. RIGGS, *Hon. M. Am. Soc. C.E., Honorary Professor, Civil Engineering, University of Michigan* Ann Arbor, Mich.

LOUIS R. HOWSON, *M. Am. Soc. C.E., Consulting Engineer, Alvord, Burdick and Howson,* Chicago, Ill.

N. T. VEATCH, *M. Am. Soc. C.E., Consulting Engineer Black and Veatch,* Kansas City, Mo.

4:00 General discussion

5:00 Adjournment

HIGHWAY DIVISION

Empire Room

ROGER L. MORRISON, *Chairman, Executive Committee, Presiding*

2:00 Introductory remarks

ROGER L. MORRISON, *M. Am. Soc. C.E., Professor o Highway Engineering and Highway Transport, University of Michigan,* Ann Arbor, Mich.

2:10 Postwar Highway Planning

HAROLD G. SOURS, *Assoc. M. Am. Soc. C.E., Director o Highways, Ohio Department of Highways,* Columbus, Ohio

2:50 Express Highway Planning for Metropolitan Areas

JOSEPH BARNETT, *M. Am. Soc. C.E., Chief, Urban Road Division, U.S. Public Roads Administration, Federal Works Agency,* Washington, D.C.

3:30 Discussion by

HARRY W. LOCHNER, *H. W. Lochner and Co., Engineer and Appraisers,* Chicago, Ill.

3:45 General discussion

4:30 Adjournment

HYDRAULICS DIVISION

Ballroom

BORIS A. BAKHMETEFF, *Chairman, Executive Committee, Presidin*

2:00 Introductory remarks

BORIS A. BAKHMETEFF, *M. Am. Soc. C.E., Consultin Engineer,* New York, N. Y.

2:10 Limitations in the Accuracy of Flood Studies

WILLIAM P. CREAGER, *M. Am. Soc. C.E., Consultin Engineer,* Buffalo, N. Y.

2:50 Discussion—General

WILLIAM G. HOYT, *M. Am. Soc. C.E., Hydraulic Engineer, Water Resources Branch, U.S. Geological Survey* Washington, D.C.

3:10 Discussion—The Unit Hydrograph

LEROY K. SHERMAN, *M. Am. Soc. C.E., Consultin Engineer,* Chicago, Ill.

3:30 Discussion—Hydro-meterological Phases

MERRILL BERNARD, *M. Am. Soc. C.E., Regional Director, U.S. Weather Bureau,* Atlanta, Ga.

3:50 Discussion—Studies for Basis of Design

EMIL P. SCHULEEN, *Assoc. M. Am. Soc. C.E., Senior Engineer, U.S. Engineer Office,* Pittsburgh, Pa.

4:10 Discussion—General

GAIL A. HATHAWAY, *M. Am. Soc. C.E., Head Engineer Corps of Engineers, Office, Chief of Engineers,* Washington D.C.

4:30 General discussion

5:00 Adjournment

Special Entertainment for the Ladies

WEDNESDAY—July 19, 1944

Morning and Afternoon

At 11:30 a.m. Wednesday morning, ladies will assemble in the Ladies Lounge (Balcony Floor), Hotel Cleveland, and walk to the Higbee Auditorium, an adjacent building, for luncheon and entertainment. Mrs. Carlyle B. Freeman will present readings from the book *"Human Comedy,"* following which there will be piano music by Vivien Harvey Slater.

Tickets for the luncheon and entertainment are $1.50 each.

Evening

On Wednesday evening all ladies will join the men to attend the informal dinner, address, and dancing in the Ballroom.

THURSDAY—July 20, 1944

Morning and Afternoon

At 11:30 a.m. ladies will assemble in the Ladies Lounge, Hotel Cleveland, and from there will be taken by special trolley to the University Center. Luncheon will be served at Wade Park Manor at 12:15 p.m. Following the luncheon, transportation will be provided to take all ladies to the Cleveland Art Museum for a gallery talk and trip through this nationally prominent museum. Mr. I. T. Frary will present an illustrated lecture on "Cleveland Gardens." Special trolleys will return the ladies to Hotel Cleveland.

Tickets for the luncheon and entertainment are $1.50 each.

Evening

On Thursday evening the ladies will join the men for the informal dinner and entertainment in the Ballroom.

Local Section Conference

TUESDAY—July 18, 1944—Morning and Afternoon

Rooms 34 and 36

FRANCIS H. KINGSBURY, *Chairman, Committee on Local Sections, Presiding*

A Local Section Conference will be held all day Tuesday, July 18, to which representatives of the following Local Sections have been invited:

Buffalo
Central Ohio
Cincinnati
Cleveland
Connecticut
Dayton
District of Columbia
Indiana
Ithaca
Lehigh Valley
Maryland
Metropolitan
Michigan
Mohawk-Hudson
North Carolina
Northeastern
Philadelphia
Pittsburgh
Providence
Rochester
South Carolina
Syracuse
Toledo
Virginia
West Virginia

The agenda of the Local Section Conference had not been completed in time for publication in this program. However, some of the subjects to be discussed at the Conference include:

Employer-Employee Relationships
The Engineer's Part in Postwar Planning
Local Section Activities
Local Section Administration

In addition to the official delegates from the Sections listed, it is hoped that many members of the Cleveland Section can arrange to be present. This Conference is open to all members of the Society, and all visitors are cordially invited to take part in the discussions.

Exhibition of Scale Models in Design of Express Highway

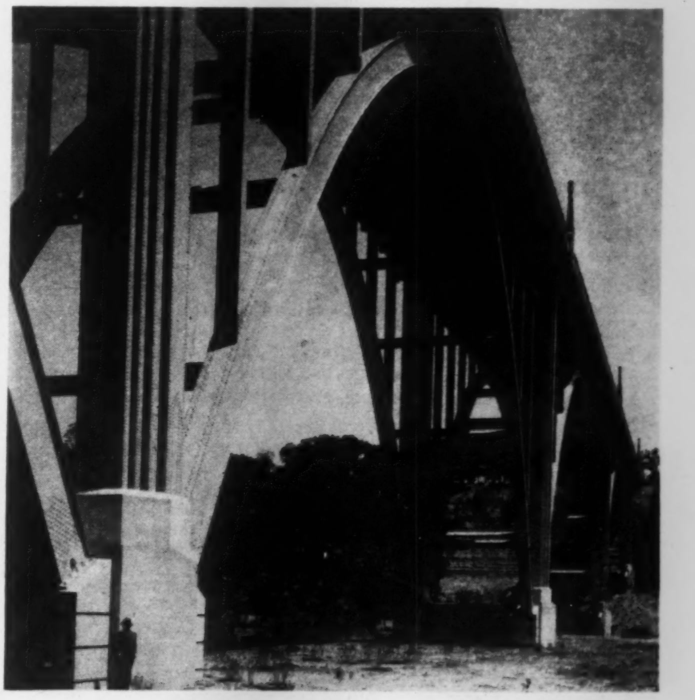
Attention is called to an interesting exhibit of scale models being used in the design of express highways by the Ohio Department of Highways. This exhibit will be located on the Balcony Floor near the Registration Desk.

Replicas of the "before and after" situations may be seen as prepared for design studies by the Ohio Department of Highways of first-order-artery interchange facilities in the heart of Cleveland. The existing development is reproduced from topographic maps (controlled by geodetic survey), from photographs, field measurements and sketches. Realistically presented are both the scene of central congestion and, in contrast, facilities being planned to accommodate heavier traffic, to be delivered, collected, and interchanged by contemplated large-capacity radial ways.

The design being so pictured is a phase of the development of an important relief-way to be, possibly the initial major improvement to be made upon the Inter-Regional Network. As an Advance Engineering Federal Aid Project, with the Public Roads Administration in consultation, the relief-way will conform with the (unofficial) express highway plan for Metropolitan Cleveland, the product of a joint study by State, County, and City for an integrated "control" for highway improvements.

* * *

This scale model exhibit has been arranged under the supervision of R. C. CHANEY, *Planning Engineer, Cleveland Office, Ohio State Department of Highways.*



LORAIN AVENUE BRIDGE—CLEVELAND

Hotel Accommodations and Announcements

Hotel Rates

Hotel	Single	Double	Twin Bed
Cleveland	$3.00 up	$3.25 up	$6.00 up
Statler	3.00 up	5.00 up	6.00 up
Hollenden	3.50 up	5.00 up	6.00 up
Carter	4.00	6.00	7.00
Olmsted	3.00	5.00	6.00
Auditorium	2.25 up	4.00	5.00

Note: The Hotel Cleveland is the hotel headquarters for the Annual Convention. Other hotels listed above are all within a half mile of headquarters hotel.

Advance Reservations

All those planning to attend the Annual Convention have been urged to make reservations well in advance of the meeting date. Those who have not done so should wire for reservations at once, indicating that they are planning to attend the Annual Convention of the Society.

Registration

The registration headquarters for the Convention will be located on the Balcony of the Hotel Cleveland and all those attending are requested to register immediately upon arrival. Tickets and badges will be obtained at the time of registration.

Information

An information desk will be provided adjacent to registration headquarters to assist visiting members in securing any desired information about the City of Cleveland. A card file of those in attendance will be maintained with information respecting their Cleveland addresses.

Entertainment for the Ladies

Attention is directed to the special program of entertainment to be provided for the ladies.

Dress

Dress for all social functions will be informal.

Local Section Conference

A conference of representatives of 25 Local Sections will meet at 9:30 a.m., Tuesday, July 18, 1944, in Rooms 34 and 36, Parlor Floor, Hotel Cleveland.

The agenda will include discussions of collective bargaining, postwar planning, and other matters of Local Section interest. All members of the Society present on Tuesday are welcome to attend.

Members of Student Chapters Invited to Convention

Members of Student Chapters who can conveniently do so are invited to participate in all events of the Annual Convention.

Officers of the Cleveland Section

Mark Swisher, *President*
Otto F. McConnell, *Vice-President*
Arthur H. Stark, *Secretary-Treasurer*

LOCAL COMMITTEES ON ARRANGEMENTS

Executive Committee

Robert Hoffmann, *Honorary Chairman*
G. Brooks Earnest, *General Chairman*

George E. Barnes
Eugene D. Barstow
Arthur F. Blaser
George W. Hamlin
James H. Herron
Allison C. Neff
Leslie J. Reardon
James C. F. Shafer
Charles H. Splitstone
Arthur H. Stark
Mark Swisher
Frank C. Tolles

Reception Committee

Frank C. Tolles, *Chairman*

John Anderson
James E. Atchison
Eugene D. Barstow
Joseph R. Burkey
Charles M. Christian
Martin E. Friedman
Emmet C. Blosser
Rollin F. MacDowell
Adriel R. McCreary
Harry H. Moseley
Samuel V. Symms

Hotel and Registration Committee

James C. F. Shafer, *Chairman*

George E. Bodwell
Theodore S. Bogardus
James W. Crall
James G. Esch
Harold W. Groth
Terrence O. Hedrick
Samuel Ward
Alfred D. Yanda
Harold A. Weggel

Entertainment Committee

Leslie J. Reardon, *Chairman*

Alfred S. Andrews
James E. Atchison
M. Sanger Brown
Otto F. McConnell
Robert C. McDowell
Allison C. Neff
Frank B. Rideout

Publicity Committee

Allison C. Neff, *Chairman*

Martin E. Friedman
Harold W. Groth
Mrs. Robert C. McDowell
Harry H. Moseley

Finance Committee

Charles H. Splitstone, *Chairman*

Barnet Baker
Carlyle B. Freeman
William D. Hicks
Kenneth H. Osborn
Arthur H. Stark

Program Committee

James H. Herron, *Chairman, Non-Technical Program*

Transportation Committee

Arthur F. Blaser, *Chairman*

Robert J. Edwards
John C. Wenrick
Commander Walter G. Will

Subcommittees on Suggestions for Technical Program

Howard W. Green, *Chairman, City Planning*
Malcolm S. Douglas, *Chairman, Construction*
James H. Herron, *Chairman, Engineering Economics*
Malcolm S. Douglas, *Chairman, Highway*
George E. Barnes, *Chairman, Hydraulics*
William L. Havens, *Chairman, Sanitary*
Milo S. Ketchum, Jr., *Chairman, Soil Mechanics and Foundations*
Sol A. Bauer, *Chairman, Surveying and Mapping*
Milo S. Ketchum, Jr., *Chairman, Structural*
Louis C. Sabin, *Chairman, Waterways*

Ladies' Executive Committee

Mrs. Charles H. Splitstone, *General Chairman*
Mrs. Mark Swisher, *Assistant Chairman*
Mrs. Arthur H. Stark, *Treasurer*
Mrs. Carlyle B. Freeman, *Secretary*
Mrs. Adriel R. McCreary, *Chairman, Entertainment Committee*
Mrs. Allison C. Neff, *Chairman, Reception Committee*

SOCIETY AFFAIRS

Official and Semi-Official

Collective Bargaining—A Historical Review

At its meeting held at St. Louis on April 24 and 25, 1944, the Board of Direction was in receipt of a few communications and a considerable number of signed petitions urging that the Board change its attitude towards prospective collective bargaining by professional engineering employees.

It was the Board's decision at that time that a statement should be prepared for publication in "Civil Engineering" which would report in brief what has happened to date in the collective bargaining matter and state the Board's reasons for continuing its action begun at its Atlanta meeting.

HISTORICAL SUMMARY

CONCERN regarding the need for help in matters of employment conditions, along with increasing pressure upon engineers to become affiliated with unions of the C.I.O. and A.F. of L. was felt by the Board of Direction as long ago as the summer of 1937. In that year a relatively large "Committee on Unionization" was created, the function of which was to report to the Board of Direction on the degree of unionization among engineers and to recommend to the Board suitable courses of helpful action. This report was submitted to the January 1938 meeting of the Board and was printed in the March 1938 issue of CIVIL ENGINEERING.

Since then, the subject has had the consideration of the Board more or less continuously. In October 1941 the Board was addressed in the form of a resolution formulated by the Local Section Conference of July 1941, wherein it was

> "Resolved that the Board of Direction of the Society shall establish a policy on a nation-wide basis for the Local Sections to follow in the matter of unionization; that it shall promptly formulate and put such a policy into action; and that it shall request the cooperation of the Founder Societies in this matter."

The Board at its January 1942 meeting broadened the function of its previously established committee, giving it the name, "Committee on Employment Conditions," and authorized the appointment of a staff member to devote his whole time to the study of the matter of engineer employer-employee problems. (CIVIL ENGINEERING, March 1942, p. 163.)

On March 1, 1942, Howard F. Peckworth was assigned as the staff member to make a survey to determine to what extent pressure groups of engineers were in existence. (CIVIL ENGINEERING, June 1942, p. 339, also Annual Report for 1942, p. 4.) In pursuance of that objective he traveled several thousand miles.

The new Committee on Employment Conditions submitted a report, analytical of the general problem, to the Board of Direction in April 1942, and a report of the nation-wide investigation was presented to the Board of Direction at its July 1942 meeting. This report disclosed the extensive activities of pressure, or bargaining, groups supported by sub-professional engineers and by those in the professional status. After submission of this report to the Board of Direction, the Board commissioned the staff to be of assistance wherever possible in matters relating to employment conditions. Since the July 1942 report, the Board has been kept informed, at each of its meetings, of many circumstances relating to the matter of employment conditions.

At the July 1942 Board Meeting, the President of the Society was in receipt of requests from two members of the Society, engaged on different projects, asking that the Society lend aid in the correction of employment conditions affecting the engineers on those projects. The Board decided that Mr. Peckworth should visit both projects immediately and bring about rectification of the unsatisfactory conditions, if possible. He visited the projects, saw the engineering employees, the contractors, the Project Engineer (U.S.E.D.), the Regional Engineer (U.S.E.D.), the Chief Engineer (U.S.E.D.), staff members of the U.S. Conciliation Service and of the National Labor Relations Board.

Many requests of similar nature or, more lately, of the nature of "how can we avoid joining the union" or of "how can we organize so as to bargain collectively in regard to our employment conditions" have been received and responses made, by telegraph, telephone, letter, and personal visit. Requests from employers asking guidance in collective bargaining matters have been responded to similarly.

To be able to answer these requests, Mr. Peckworth studied the many Federal laws and the administrative decisions relating to employment conditions and collective bargaining procedures. A summary of these laws, and decisions, in relation to both engineering employees and employers of engineers, was produced upon instruction from the Board of Direction at its January 1943 meeting and ordered printed and distributed by the Board to the Local Section presidents and secretaries, and elsewhere. (Manual No. 26, issued July 1943; CIVIL ENGINEERING, September 1943, p. 443; CIVIL ENGINEERING, December 1943, p. 591.)

Under date of October 20, 1942, the District of Columbia Section called upon the Board to

> "Prepare an outline of a skeleton organization with national headquarters and state branches to be formed as a subsidiary of one or all of the Founder Societies which would be generally controlled by the Society as to policy and yet directly or through its state branches or subsidiary local groups could legally serve as a bargaining agency in the eyes of the law and could charter local groups in outlying areas."

Copies of this resolution were sent, by the District of Columbia Section, to all Local Sections. (CIVIL ENGINEERING, March 1943, p. 149.)

THE SUNFLOWER CASE

In May and June 1943 the professional engineering employees engaged upon the Sunflower Ordnance Works near Kansas City, Mo., sought to be segregated from Local Union No. 30 of the International Federation of Technical Engineers, Architects and Draftsmen's Unions (A.F. of L.) which was making claims of the Contractor on that project, a member of the Society. Upon their urgent request and those of certain members of the Board, Mr. Peckworth was sent to assist the professional engineering employees on that project as "*amicus curiae*," commonly expressed as "a friend of the Court."

The services of a prominent legal firm in Kansas City were engaged to assist him and them. A Panel, appointed by the Regional War Labor Board, made an exhaustive study of the situation, finding that the professional employees for a period in excess of a year, had not acted in their own interest. In addition, the professional group had difficulty in defining its members. As a result the professional group was unsuccessful in securing approval of its point that on that project a unit of professional engineering employees should be recognized separately from Local No. 30.

The Panel of the Regional War Labor Board recognized Local No. 30 of the IFTEA and DU of the A.F. of L. as the appropriate bargaining unit, stating:

> "The Panel recommends that no distinction be made between professional or sub-professional engineers in the definition of the unit as eventually determined by the Regional War Labor Board.
>
> "The Panel further recommends that the Regional War Labor Board issue a directive ordering the company to recognize Local No. 30 as the collective bargaining agent for the

non-manual technical employees of the company as heretofore described." (CIVIL ENGINEERING, July 1943, p. 337; August 1943, p. 394; October 1943, p. 501.)

The procedure followed by the A.F. of L. in the Sunflower Case is being followed in other places by both the A.F. of L. and the C.I.O. The case of the Sunflower Ordnance Works is cited because in many ways it is typical, also because it was influential in determining future actions of the Executive Committee and the Board of Direction.

The situation at the Sunflower plant, being known to the Executive Committee of the Society, sitting in formal meeting July 30, 1943, it instructed the staff to seek some place where a collective bargaining group of professional engineering employees could be formed prior to the formation of a sub-professional union, and to seek its recognition by the National Labor Relations Board and the War Labor Board as a precedent. An attempt to do so proved unsuccessful primarily because of the physical circumstances relating to the methods of processing the work, and the residence conditions on the project selected. (CIVIL ENGINEERING, September 1943, p. 443.)

Annual Convention—Cleveland

Special interest attaches to the Society's Convention, to be held on July 19–21. Departing from custom, it will be in the Middle West, at the Hotel Cleveland, Cleveland, Ohio. In order, the special events include a Local Section Conference on Tuesday, July 18, Business Meeting on Wednesday morning at which the President will give his Annual Address, a session devoted to Postwar Problems on Wednesday afternoon, and meetings of ten Technical Divisions on Thursday and Friday. Of particular note are the plans for discussion of depreciation at the Engineering Economics Division session. The complete program will be found on page 305. Railroad and hotel reservations should be made at the earliest possible date.

BOARD ACTION AT ATLANTA, OCTOBER 1943

During 1942 and 1943 there was an increasing consciousness by the Board of a demand by the membership at large for the formulation of a policy on a nation-wide basis in relation to this matter of employment conditions. The Society's Committee on Employment Conditions was composed of men acutely aware of these situations and these trends. The Committee met in Albuquerque September 11 and 12, 1943, in an attempt to formulate such a nation-wide policy as suggested for use in each Local Section area. At that meeting, the Committee on Employment Conditions formulated the report which was adopted by the Board of Direction at its meeting held in Atlanta, October 1943.

This report consists of three parts: (1) It recommended that each of the Local Sections amend its constitution so as to make it possible for the employee members to form groups for the purpose of collective bargaining. This form of amendment was drafted with the aid of the same legal firm that had been retained in connection with the Sunflower Case. (2) It recommended that the Society allocate funds to retain legal counsel and to employ four Field Representatives to assist and advise the various Local Section Committees on Employment Conditions proposed to be established by the constitutional amendments. (3) It recommended that the Board approve a definition of "Professional Engineering Employees" used in the sense that persons capable of being so designated may join with others capable of being similarly designated for the purpose of collective bargaining separately from any other group of persons not capable of being so designated.

After adopting the Report, the Board of Direction appropriated $50,000 for legal expenses and those of the Field Representatives and directed that the Report of the Committee be forwarded to the Local Sections officers and printed in CIVIL ENGINEERING. (CIVIL ENGINEERING, November 1943, p. 552.)

At its January 1944 meeting the Committee on Employment Conditions reported that although 13 Local Sections had amended their constitutions as recommended by the Board, it did not appear probable that the appointment of the proposed four field representatives would be necessary in the year 1944, and further that the Society's legal counsel had advised that the appointment of staff members of the Society to perform primarily the function of assisting in collective bargaining procedures might cause the Society to be considered a "Labor Organization" under the laws of the State of New York.

ANNUAL MEETING, JANUARY 19, 1944

At a recessed Business Meeting of Society members at the time of the Annual Meeting, some three and a half hours were devoted to a discussion of the following motion:

> "Moved that the Board of Direction, at its stated meetin tomorrow, January 20, reconsider: (1) the action of the Boar of Direction at its Atlanta meeting, October 11, 1943, wit respect to the adoption by the Board of the report of th Society's Committee on Employment Conditions; and (2 defer any further action on the matter until the whole mem bership of the Society has had an opportunity to review th pertinent facts in the case and express its views to our hono able Board."

After three speakers, familiar with the matter, had opened th meeting some eighteen of those present spoke to the motion Standing vote at the close of the meeting showed 97 in favor o the motion and 120 against. Th motion was declared lost. (CIVI ENGINEERING, March 1944, p. 120

GROUP ACTION AS A RESULT OF TH RECOMMENDATION OF THE BOARD

Meanwhile the Tennessee Valley Section of the Society, in accordance with the recommendation o the Board of Direction, amended its Constitution at its meeting i Knoxville in November 1943 making provision for a local Committe on Employment Conditions and a local group of the professional engineering employees in that Section area. Action was taken by thi Local Section prior to specific suggestions regarding procedure, forwarded later to all Local Sections A group was formed in Tennessee called the Tennessee Association o Professional Engineering Employees (TAPEE). It adopted a simple Constitution. It operated originally under an Interim Committee elected by the employee members of the Section. Th same persons were reelected later as the permanent Committee o Employment Conditions. Membership in the group conformed to the qualifications expressed by the Board of Direction in its definition of professional engineering employees, and the member of the group delegated their bargaining rights to their local Committee on Employment Conditions.

Prospective members upon application for membership i TAPEE were examined by a special Committee of employe members appointed by the Committee on Employment Conditions to determine whether they met the qualifications of the definition Many of the members in TAPEE are professional engineering employees—Civil, Mechanical, Electrical, and Chemical—who work on the Clinton Engineer Works, near Knoxville, a Government project being constructed by several prime contractors fo the War Department.

An affiliate of the A.F. of L., the International Federation o Technical Engineers, Architects and Draftsmen's Unions (IFTEA and DU) started to organize all the engineering employees on th Clinton Engineer Works some time in late 1943. A number o public meetings were held, and these meetings were attended by engineers both sub-professional and professional. The IFTEA and DU claims to have in its membership a majority of the engineering employees, sub-professional and professional, combined working on the Clinton Engineer Works.

The Tennessee Association of Professional Engineering Employees grew rapidly after its start in November of 1943. Before long, it contained a majority of the professional employees working for the J. A. Jones Construction Company and the professional employees of that company constituted themselves a legally appropriate bargaining unit. As soon as a clear majority was reached in that company, the TAPEE claimed the bargaining rights and signed a collective bargaining agreement covering wages, hours, and working conditions for the professional engineering employees working for the Jones Company. Somewhat previously, membership in TAPEE included a majority of the professional employees working for the Harrison Construction Co. Thus appropriate bargaining units were formed and two collective bargaining agreements were signed.

The largest employer at the Clinton Engineer Works is the Stone and Webster Company, and among the employees of that company IFTEA and DU claim to have a majority of all the non-manual technical employees; whereas TAPEE claims to have a majority of all the professional engineering employees. IFTEA and DU has asked the employer that it be recognized as the appropriate bargaining unit for all the technical employees, and TAPEE has asked the employer that it be recognized as the appropriate bargaining unit for all the professional engineering employees. Thereby there arose a clear-cut dispute over the appropriate bargaining unit, or units, among the employees of the Stone and Webster Company at the site of the Clinton Engineer Works.

The IFTEA and DU demanded that the employer recognize it. The employer refused because of the representations made by TAPEE. As a result IFTEA and DU appealed to the U.S. Conciliation Service on the grounds that the employer would not recognize it. The U.S. Conciliator was unable to resolve the dispute because the employer refused to recognize either IFTEA and DU or TAPEE on the grounds that he did not know which group properly should be recognized. The Conciliator then referred the matter to the National Labor Relations Board in order that that Board might determine the appropriate bargaining unit by consent election.

This consent election was denied by the War Department for reasons of national security and the labor union expressed disapproval in the form of a 30-day call for a "Strike Vote," under the provisions of the Smith-Connolly Act. The newspapers in Knoxville spread almost daily a claim of the union that the TAPEE was preventing the union from obtaining its legal rights. Upon the eve of the proposed "Strike Vote" the TAPEE inserted advertisements in the newspapers calling upon all engineers to cast their ballots against the proposed strike. The labor union called off the proposed strike vote.

As the Clinton Engineer Works is a confidential war project, the National Labor Relations Board referred the matter to the War Labor Board on the grounds that the project has to do with the prosecution of the war. The War Labor Board appointed a Local Panel and the Local Panel had a hearing in the matter at which TAPEE was represented by legal counsel, as *amicus curiae*, furnished by the Society. As a result of its hearing the Local War Labor Panel recommended to the Regional War Labor Board that it determine the appropriate bargaining unit. TAPEE on the advice of counsel has taken procedural steps to insure being heard by any agency authorized to determine the appropriate bargaining unit.

Protection of the Status of the Profession

The Executive Committee of the Society at its meeting held on March 29, 1944, being informed of the situation, considered it as fundamental that the status of the profession be protected through the medium of this particular case. The Executive Committee authorized the engagement of special legal talent to assist, as a friend of the court, in this endeavor of the professional employees to be excluded from affiliation with IFTEA and DU of A.F. of L. and to be recognized as an independent appropriate bargaining unit representative of professional employees. The expenses incurred, other than legal assistance provided by the Society, have been paid from the group dues collected from members of TAPEE.

In one other case, in a Local Section area where the recommendation of the Board has not as yet been acted on, a somewhat comparable matter has gone to the National Labor Relations Board without help from the Society.

Subsequent Committee and Board Actions

The Society's Committee on Employment Conditions held a meeting on March 19, 1944, in Washington to discuss the situation as it existed at the Clinton Engineer Works. It developed "Interpretations" of its first proposed amendment, on the basis of comments by the Society's legal counsel, and directed that those interpretations be issued to all the Local Section presidents and secretaries. This document, and its supplements, suggested how to institute a Group of Professional Engineering Employees, the rules and regulations that such a group should adopt and the membership application form that should be used—all considered desirable to make preparations for rendering aid in collective bargaining appropriate under the law. (Civil Engineering, May 1944, p. 214.)

The essential difference between the first suggested amendment and the new ideas decided upon to make it more satisfactory from all points of view, is that the Local Section assemblages of professional engineering employees should be "Groups" of such employees ready to be of assistance to "Units" of such employees of a specific employer, where apparently necessary or advisable with respect to that specific employer. A second essential difference is that it removes bargaining "units" from affiliation with the Society and the Section and provides that they must be self-administered and self-financed by their employee members.

At the St. Louis meeting of the Board on April 24 and 25, 1944, the subject was discussed from many angles. Counterparts of two forms of petitions, signed by 293 Corporate Members of the Society, were reviewed. All the petitioners urged the Board to subject the whole matter to a referendum of the Corporate Membership of the Society. Using the other form, a few petitioners urged that the Board make its action taken at Atlanta "ineffective" pending the consummation of the proposed referendum. [As of June 15, a total of 588 petitions had been received at Headquarters.] Other correspondents protested the attitude adopted by the Board, a few asserting that the views of those opposing the actions of the Board had not been given fair opportunity for expression in Civil Engineering.

All such comments were received as welcomed by the Board in that they provide suggestions that may prove helpful in further actions that the Board may take. However, the request of the petitioners that a referendum to the Corporate Membership of the Society be made, was acted upon unfavorably. The Board had knowledge that at that time 25 Local Sections had adopted amendments to their Constitutions, that in 2 Local Sections vote on an amendment had failed, and that in 3 Local Sections it had been decided by the local Boards of Directors that the matter would not be put to vote. Also it was known that in 2 instances local committee reports unfavorable to the matter had been put to vote and accepted.

In the 27 Sections where an amendment had been put to vote, 2,435 members of the Society had voted favorably and 365 in disfavor. This the Board viewed as being more than the equivalent of a referendum to Corporate Members only, as Juniors, to whom the matter is one of concern, had voted in the Sections.

Amendment to the Wagner Act

When the original Committee on Unionization was formed in 1937, one of its first assignments was a review of the Wagner Act and an appraisal of the possibility or advisability of attempting to have the Act amended or its administration influenced so as to protect specifically, or to exclude from its provisions, professional employees. The Committee's findings in that matter are expressed in its report to the January 1938 meeting of the Board and printed in the March 1938 issue of Civil Engineering.

The Committee on Employment Conditions conducted a similar appraisal in the Summer of 1942. This second study confirmed the findings of the Committee on Unionization as reported in 1938 and emphasized to the Committee members the futility of trying to amend, or influence the administration of, the Wagner Act at this time and without the support of all the professional bodies in the country.

Again, at the January 1944 meeting of the Board, the question was raised regarding the possibility or advisability of attempting at this time to have the Act amended or its administration influenced so as to protect or exclude professional engineering employees. A committee was authorized to investigate the Wagner Act again from all possible angles. However it is the present attitude of the Board that even if it appears possible to segregate professional employees from trades and labor employees, through an amendment of the Wagner Act, there still remains the necessity of protecting the rights and privileges now accorded employees by that Act. Further if professional employees are denied the rights of collective bargaining then some preferential position must be granted them in exchange. Efforts are being made to secure the interest and aid of other engineering societies in this direction.

Similar Activities in Canada

The Board has been aware of what is going on in Canada where by decision of the Dominion's War Labour Relations Board, the engineers of Canada have been excluded for a period of six months from the new labor code P.C. 1003, stipulating compulsory collective bargaining and arbitration. The Dominion's War Labour Relations Board took this action as a result of a request sponsored by all the major Canadian engineering societies. For a period of six months, terminating October 12, 1944, professional employees in Canada are to be considered as confidential employees of management and therefore exempt from bargaining procedures.

At the end of the six months' period, if no further convincing representations are made, professional employees will fall automatically under the provisions of the War Measures Act. If, at that time, proper representations are made, they will be given consideration by the Canadian War Labour Relations Board and legislative officials. At present in Canada there is no agreement among engineers on the program to be presented at the end of the six months' period. Nevertheless it is being discussed in terms of three proposals.

(1) Collective bargaining for all employees including professional employees, similar to the present provisions of the War Measures Act, which is basically similar to the Wagner Act in this country.

(2) The formulation of an Act for the professions, separate and distinct from the War Measures Act, which will allow collective bargaining by professional employees free from interference by trades and labor groups.

(3) The formulation of an Act for the professions, separate and distinct from the War Measures Act, without collective bargaining but containing some other effective provisions which will give rights to the professional employees similar to the rights those employees would obtain through collective bargaining.

This statement, as has been said, has been prepared upon instructions from the Board of Direction in order that the members of the Society may be provided with a full account of what led the Board to the proposal it adopted at its meeting in Atlanta, in October 1943, and to which it voted to adhere at St. Louis in April 1944.

June 15, 1944

MALCOLM PIRNIE, *President*
GEORGE T. SEABURY, *Secretary*
A. M. RAWN, *Chairman, Committee on Employment Conditions*

SOUVENIR OF THE ST. LOUIS SECTION'S 1944 SPRING MEETING

This fine example of the photographic work of William C. E. Becker, M. Am. Soc. C.E., pictures an interesting moment during the introductions at the dinner on April 26, at the Coronado Hotel. In the usual order at the speakers' table appear Secretary George T. Seabury, President Malcolm Pirnie, presiding officer R. W. Hodson, head of the St. Louis Section, and Prof. Gus. Dyer of Vanderbilt University, Nashville. An account of the meeting, with reference to Professor Dyer's brilliant address at the dinner, appeared in the June issue.

E.C.P.D. Committee Reports on Technical Institutes

RECOGNITION and certification of technical institutes has bee recommended by the Subcommittee on Technical Institutes of th Engineers' Council for Professional Development. In a repor issued in April 1944, the committee recognized the widesprea activities of such educational institutions and demonstrated th need for an accrediting program carried out by E.C.P.D.

Types of institutions offering technical training are widel diversified, including both public and private schools, junior co leges, extension divisions, and correspondence schools. Typica are Wentworth Institute, Los Angeles City College, and the International Correspondence Schools. The courses offered vary wit the demands of industry. At present many schools devote the entire emphasis to one field, such as aeronautics.

Data on enrolment in technical institutes have been difficult t ascertain because of the variety of programs offered. The repor lists over 150,000 individuals enrolled in 1940–1941 and recognize that the statistics are incomplete. During the period of wa training courses administered by the U.S. Office of Education nearly a million and a half enrolments have been recorded. Thi covers the years from 1940 to 1944.

In the opinion of the committee, it is probable that considerabl training of the technical institute type will be continued permanently. The federal government, for instance, is now makin plans to finance the training of returning veterans and displace war workers. On this premise is based the recommendations o the committee, which follow:

"1. We recommend that recognition or certification of educational programs of technical institute type be initiated by E.C.P.D. since it is the only agency of the engineering profession which ha the status, backing, and public recognition necessary to insur acceptance of such certification. It would be appropriate at th beginning to entrust the organization of the movement to the Committee on Engineering Schools.

"2. We recommend further that under the auspices of E.C.P.D. an accrediting group be set up which would include representatives of institutions offering educational programs of the technical institute type and of industries served by them, and that these representatives have as large a share as possible in conducting th accrediting procedures. In time, a new committee of E.C.P.D. may come into existence for the purpose of promoting the interests and insuring soundness of technical institute education. It is also possible, as an alternative, that these institutions will wish eventually to establish their own accrediting organization. It appears, however, that at present they do not have enough solidarity o unity of purpose to organize such a program.

"3. We recommend that this movement, as described above, be inaugurated as soon as this can be done appropriately in view of the war situation."

Engineering Library Commended for War Service

AFTER two years of cooperation with the Office of the Chief of Engineers, the Engineering Societies' Library in New York has received a letter of commendation from Col. H. B. Loper, Chief of the Military Intelligence Division, Office of the Chief of Engineers, Washington, D.C.

The letter states in part:

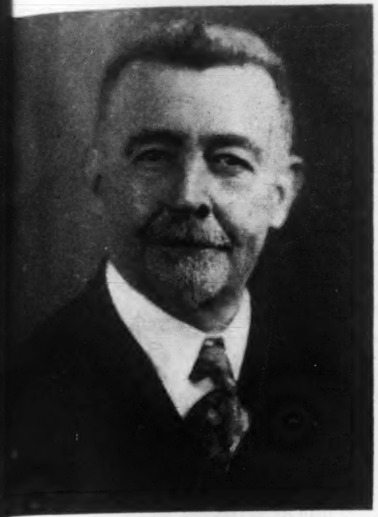
"The assistance of the Engineering Societies' Library has been the chief reason why our Engineer Research Office in New York City has been able to provide this office, the planning staffs in Washington, and the theatre commanders with urgently needed information on the details of engineering facilities in enemy-occupied countries."

The letter goes on to say that requests for voluminous amounts of material were met with unfailing cooperation. The result has been that the processed information has proved very helpful to those concerned with both planning and operations. It will be a source of pride to engineers to know that their headquarters library has been able to make this valuable contribution to their country in its time of need.

Past-President John F. Coleman Dies

A NOTABLE engineering career was ended when John F. Coleman, ast-President and Honorary Member of the Society, died in New rleans, La., on June 3, 1944. Mr. Coleman, who was 77, had een ill for several months.

He was born in Jefferson County, Mississippi, shortly after the ose of the Civil War, but spent most of his life in New Orleans. ollowing his graduation from the public schools there, he engaged r a time in railroad location and construction, but soon returned o New Orleans and settled down. From 1896 to 1900 he was rincipal assistant city engineer, and from the latter year on was in eneral practice—under the firm names of Coleman, Malochee and Villere, J. F. Coleman, and the J. F. Coleman Engineering Company.


JOHN F. COLEMAN, 1866–1944

During this long period hydraulic projects demanded much of Mr. Coleman's attention, and he became one of the leading marine terminal engineers of the South. He served as consultant to the ports of New Orleans, Jacksonville, Charleston, Mobile, Houston, and Corpus Christi, as well as to a number of railroads, public service corporations, and industrial concerns. Since the outbreak of the war, Mr. Coleman had been in Washington—s assistant chief engineer for the Defense Plant Corporation and, more recently, as engineer adviser for the Reconstruction Finance Corporation.

In the earlier days of the Reconstruction Finance Corporation Mr. Coleman was one of five members appointed by President Hoover to the Engineering Advisory Board of the Corporation. Other honors accorded him included the presidency of American Engineering Council and of the American Institute of Consulting Engineers.

In the Society, of which he became a member in 1901, Mr. Coleman has held offices of increasing importance. He was Director from 1915 to 1917, Vice-President in 1918 and 1919, and President in 1930. In this latter year CIVIL ENGINEERING was started, and Mr. Coleman contributed a presidential statement to the very first issue. He was elected Honorary Member of the Society in 1935.

He was a highly respected member of the profession. His wonderful character, courtly bearing, and mature judgment made him well and favorably known in engineering circles throughout the country. His multitude of friends in the Society will sincerely mourn him.

Civil Engineering Construction Analyzed by Postwar Committee

AMONG the activities of the Research and Development Division of the Society's Committee on Postwar Construction is the rather important one of reporting periodically its studies on the current volume of engineering construction actually in the design stage. The following summary of some of these investigations is submitted by Mark B. Owen, M. Am. Soc. C.E., Director of the Division.

At the present time only factual data on the status of civil engineering construction is available to the Committee. It is hoped that information covering a wider band of all construction may be provided in the near future. All construction includes light "non-engineered" work, maintenance, housing built by handcraft methods, and civil engineering construction. Water works, sewerage, roads and streets, bridges, earthworks, public and private buildings, and miscellaneous unclassified projects such as pipe lines make up the volume of engineering construction.

PREWAR CONSTRUCTION

Owing to certain military activities and war orders placed by foreign governments with our industries, the effect of this war on certain classes of construction was noticeable during the last half of 1940. For example, there was a large increase in the volume of construction of public and commercial buildings, and unclassified projects such as airports. Strictly speaking, prewar construction terminated with the close of the first six months of 1940.

The study of the volume of prewar engineering construction (Table I) covers the years 1925 to 1940 inclusive. The total dollar volume for public and industrial buildings and unclassified projects has been adjusted on the basis of the previous 15-year average. The data do not indicate that other types of construction were affected by the war during 1940.

TABLE I. PREWAR ENGINEERING CONSTRUCTION, IN MILLIONS OF DOLLARS, FOR 16 YEARS, 1925–1940

	TOTAL	% OF TOTAL	AVERAGE PER YEAR
Water works	$ 1,277	3.2	$ 79.8
Sewerage	1,462	3.6	91.3
Roads and streets	7,922	19.7	495.1
Bridges	1,924	4.8	120.2
Earthwork	2,346	5.9	146.6
Unclassified	4,553	11.3	284.5
Buildings:			
Public	5,120	12.8	320.0
Industrial	4,270	10.6	266.9
Commercial	11,247	28.1	703.0
Total	$40,121	100.0%	$2,507.5

The goal of the Committee is to have construction plans ready for bids July 1, 1945, totaling 15 billion dollars. Of this sum, 10 billions is estimated to be engineering construction. If we may reasonably use the prewar annual averages for the various types of work for projecting postwar potentials, related to a 10-billion-dollar program of engineering construction, Table II will represent a forecast of that volume in millions of dollars.

TABLE II. ESTIMATED COMPOSITION OF 10 BILLIONS OF POSTWAR ENGINEERING CONSTRUCTION

Water works	$ 320 millions
Sewerage	360
Roads and streets	1,970
Bridges	480
Earthwork	590
Unclassified	1,130
Buildings:	
Public	1,280
Industrial	1,060
Commercial	2,810
Total	$10,000 millions

PRESENT STATUS OF POSTWAR CONSTRUCTION DESIGNS

As of May 31, 1944, and cumulative from January 1, 1943, the statistics in Table III, adopted from data of *Engineering News-Record*, show the volume of postwar construction for which plans are under way or completed, in millions of dollars, for the entire United States.

TABLE III. PRESENT U.S. POSTWAR PLANNING

Water works	$ 169.2 millions
Sewerage	303.6
Roads and streets	706.2
Bridges	330.0
Earthwork	220.2
Unclassified	386.7
Buildings:	
Public	456.0
Industrial	21.5
Commercial	61.8
Total	$2,655.2 millions

A detailed study of the distribution of the volume in Table III, by states, shows that $1,426,147,000, or about 54% of the total, is reported from New York, Ohio, Texas, and New Jersey, leading in that order. Over 81% of the total is reported from 12 states.

It is obvious that far too much of our national postwar planning for construction is still in the "talking" stage. We must proceed to action now!

Allen P. Richmond Rejoins Staff

AFTER an interval of almost three years spent in Army service, Allen P. Richmond, Jr., is again back in civilian life and Society work. He took up once more his duties at Headquarters, as assistant to the Secretary, on June 19.

As Lieutenant Colonel in the Field Artillery Reserve, he served on a series of assignments in the Army. In the national headquarters of the Selective Service System, he assisted in organizing and compiling the Code Index of Occupations for the analysis of occupational statistics by punch cards. Next, in the War Department, he was Assistant Executive Officer in the Plans and Training Section. After taking the G-3 course at the Command and General Staff School at Fort Leavenworth early in 1942, he became chief of the Field Artillery Section of the Organization Division, Headquarters Army Ground Forces, charged with preparing Tables of Organization and Equipment for Field Artillery units.

After a year of this work, he requested duty with troops, and was detailed in the Coast Artillery (Anti-Aircraft) and sent to Camp Edwards, Mass., where he trained a mobile gun battalion. Becoming over age in grade, Colonel Richmond was then detailed as Acting Inspector of Training for that Training Center.

At his own request, he was released from active duty on June 1, to return to the Society's staff. There he will again be responsible for activities in connection with engineers' classifications and salaries, Student Chapter work, and numerous other details, all of which are in need of further stimulation. As his return means relief to the hard-pressed Headquarters staff in this work, as well as a renewal of pleasant personal associations, he has received a hearty welcome.

ALLEN P. RICHMOND, M. AM. SOC. C.E.

News of Local Sections

Scheduled Meetings

OKLAHOMA SECTION—Luncheon meeting at the Oklahoma City Y.M.C.A. on July 15, at 3:30 p.m.

SACRAMENTO SECTION—Regular luncheon meetings at the Elks Club every Tuesday at 12:15 p.m.

SAN FRANCISCO SECTION—Dinner meeting of the Junior Forum at the Engineers' Club on July 27, at 6 p.m.

TENNESSEE VALLEY SECTION—Dinner meeting of the Knoxville Sub-Section at the S & W Cafeteria on July 10, at 5:45 p.m.

TEXAS SECTION—Luncheon meeting of the Fort Worth Branch at the Blackstone Hotel on July 10, at 12:15 p.m.

Recent Activities

ALABAMA SECTION

The spring meeting of the Section took the form of a two-day session, held in Montgomery on May 12 and 13. A field trip to Montgomery's new water-works project initiated activities on Friday morning. City Engineer O. L. Skinner and R. L. Kenan, consulting engineer, personally supervised the trip. During the afternoon session prizes were awarded in the annual Student Chapter competition, the recipients being W. Elliott Dunn and Milton Hill, both of the Alabama Polytechnic Institute Chapter. Mr. Dunn read his paper, which was entitled "The Need of a Postwar Highway Planning Program." Then E. B. Bruce gave interesting side lights on engineering and construction in the wilds of Africa. Speakers at the evening dinner meeting were James E. Jagger, Acting Assistant Secretary of the Society, who commented on Society affairs, and Col. Richard T. Rives, Montgomery attorney at law. The Board of Directors of the Section met at breakfast the following morning to discuss business matters, after which Vincent Smith spoke on what the civil engineer can do to promote postwar construction. Mr. Smith is executive director of the research and development division of the Society's Committee on Postwar Construction. Later in the morning Gilbert H. Dunstan, associate professor of sanitary engineering at the University of Alabama, spoke on the stream pollution survey of the Black Warrior River, and R. F. Lane discussed the new leveling rod and leveling process. The latter is chief of location party for the Alabama State Highway Department.

ARIZONA SECTION

On April 29 members of the Arizona Section gathered in Tucson for their annual spring meeting. The morning session was devoted to routine business and committee reports and to a discussion of the subject of collective bargaining. At the luncheon meeting that noon Clyde Myers discussed further aspects of collective bargaining. The afternoon technical program consisted of the presentation of papers by John C. Park, professor of highway engineering at the University of Arizona, whose subject was soil mechanics; R. M. Cushing, engineer for Headman, Ferguson, and Carollo, of Tucson, who spoke on the Tucson sewage disposal plant; and Andy M. Faure, of the Tucson Planning Commission, who discussed a "Comprehensive Plan for the Tucson Region."

BUFFALO SECTION

At the May luncheon meeting of the Section the speaker was Allen J. Greer, colonel, U.S. Army, retired, who gave a résumé of the current military situation, describing the various campaigns and sectors of war. Colonel Greer believes that the war in the Pacific has been conducted in a nearly perfect manner and that our attack on the Japanese mainland is not as far off as many think

CENTRAL ILLINOIS SECTION

On May 11 the Section held a joint dinner meeting with the Student Chapter at the University of Illinois and the Champaign County Chapter of the Illinois Society of Engineers. During the evening it was announced that the Section's prizes of Junior membership in the Society go this year to John C. Ascherman, Hugh T. Boyd, and Robert P. Buettner, all of the University of Illinois The technical program consisted of a talk on the physical effects of high-altitude flying, given by Dr. Frederic R. Steggerda, associate professor of physiology at the University of Illinois.

CLEVELAND SECTION

"Great Lakes Engineering, Economics and Transportation" was the topic of discussion at the May dinner meeting of the Section, the principal speaker being Louis C. Sabin, vice-president of the Lake Carriers' Association. Since the early part of the nineteenth century, Mr. Sabin pointed out, the Corps of Engineers of the U.S. Army has been developing the Great Lakes harbors which can accommodate very large freighters. The canal at the Soo handles more traffic than all the rest of the canals in the world combined. Furthermore, all this traffic is moved in eight months as the canal is ice bound the rest of the year.

COLORADO SECTION

Student Chapter members from the University of Colorado were guests of the Section at the meeting held on May 8. An illustrated talk on the deserts of Utah comprised the technical session

This was given by Carroll H. Wegemann, member of the Explorers' Club of New York and the Adventurers' Club of Chicago. Mr. Wegemann described the scenic and geologic wonders of the Colorado River Basin in eastern Utah near the junction of the Green and Colorado rivers.

CONNECTICUT SECTION

On May 17 James A. MacAlamey, colonel, Corps of Engineers, U.S. Army, addressed a meeting of the Section on his work in building bituminous runways in Lybia and Saudi Arabia. Natives employed on this work often brought their wives and daughters, who did most of the work! Lt. Robinson D. Buck then discussed his work in the Sanitary Corps of the Army, and Captain Chandler, of the U.S. Navy, discussed the setup of the Seabees and showed a film of the Seabees at work in the South Pacific battle zones. A talk by Lt. S. G. Mastriani concluded the program. Lieutenant Mastriani, who has just returned from active service at Guadalcanal, cited the many difficulties faced in laying out air fields in jungle country, where the average temperature is 130 deg and the annual rainfall 250 in.

DISTRICT OF COLUMBIA SECTION

Part of the May meeting of the District of Columbia Section was devoted to the presentation of committee reports. The principal speaker on the technical program was H. S. Fairbank, deputy commissioner of the Public Roads Administration, who addressed the gathering on the subject of inter-regional highways. (Mr. Fairbank had a paper on this subject in the June issue of CIVIL ENGINEERING.)

ILLINOIS SECTION

A joint luncheon meeting of the Section with the Chicago Engineers' Club took place on May 26. A talk on special applications of high-strength concrete was the feature of the occasion. This was given by Prof. G. A. Maney, of the Northwestern Technological Institute, who illustrated his talk with a number of slides. Special emphasis was placed on the possible use of high unit stress concrete that may be obtained by prestressing. By prestressing the green concrete up to 30,000 lb per sq in. and using approximately 15% of spiral reinforcing, unit stresses up to 100,000 lb per sq in. have been obtained. Such unit stresses would permit the use of concrete columns of very modest size in even our highest buildings.

IOWA SECTION

In May the Section held two joint meetings with the Student Chapter at Iowa State College. The speaker at the first of these sessions, which took place in Ames on the 18th, was L. C. Crawford, district engineer for the U.S. Geological Survey at Iowa City. Mr. Crawford discussed community and state postwar planning, pointing out some of the organizational problems that exist locally and showing what the engineering societies are doing to solve these problems. On the 29th, Lt. Comdr. M. G. Spangler spoke on the Civil Engineering Corps of the U.S. Navy, illustrating his talk with a sound movie of the Seabees in action.

KANSAS SECTION

At the May meeting of the Kansas Section—held in Topeka on the 19th—Maj. H. J. Dixon, Headquarters District No. 4, Seventh Service Command, was the guest speaker. Major Dixon discussed the duties and functions of his department and exhibited an official War Department film. During the evening the Sections annual awards of Junior membership in the Society were presented to Byrle Womble, of Kansas State College, and to Ensign Robert Warham Lamberton, of the University of Kansas. The latter presentation was made in absentia. A number of Student Chapter members from the University of Kansas were guests of the Section for the occasion.

KENTUCKY SECTION

A combined meeting of the Kentucky Section and the Student Chapters at the University of Kentucky and the University of Louisville took place in Lexington on May 19. In the annual competition conducted by the Section for the best student papers the following awards were made: first prize of $15 to M. C. Welch; second prize of $10 to C. W. Lovell, Jr.; and third prize of $5 to R. T. Zeller, Jr. Prizes for the outstanding student from each school were won by Mr. Lovell, of the University of Louisville, and James A. Caywood, of the University of Kentucky.

LOS ANGELES SECTION

The May meeting of the Section was held at the California Institute of Technology in Pasadena on the 10th. Before dinner was served members and guests were invited to inspect some of the unusual projects at the Institute. The technical part of the program had been arranged by the Student Chapter and featured several speakers. These included Mark Serrurier, structural engineer in charge of one of the projects now being built for the Navy, whose talk was confidential because of the nature of his work; Vito A. Vanoni, project supervisor of the cooperative laboratory of the Soil Conservation Service, whose subject was the transportation of sediment; and Dr. Hans Albert Einstein, who amplified Dr. Vanoni's discussion and showed the application of the principles he cited to a practical study of erosion and the deposition of sediment.

MARYLAND SECTION

At the May meeting of the Section, Society Director Charles F. Goodrich made his first appearance before the Maryland Section since it became a part of his District. Mr. Goodrich spoke of the work being done by the various Society committees, particularly the Committees on Postwar Construction and Employment Conditions. He was followed by Dr. Wilson Shaffer, professor of psychology and dean of the college of arts and sciences at the Johns Hopkins University, who gave an address on the psychology of humor.

METROPOLITAN SECTION

At the annual meeting of the Section, which took place on May 17, William M. Griffin was elected president for the coming year, and Harry O. Locher vice-president. William J. Shea will continue as secretary-treasurer. A talk entitled "War Jobs and Then What?" comprised the technical program for the occasion, the speaker being William N. Carey, colonel, Corps of Engineers, U.S. Army. Colonel Carey, who is chief engineer of the Federal Works Agency and former Director of the Society, discussed the relationship between construction and the general economy in the immediate postwar period. The principal speaker at the April meeting of the Section was L. F. Chen, president of the American section of the Chinese Institute of Engineers. Dr. Chen, who represents the Chinese National Resources Commission in the United States, discussed the role of the engineer in building the China of tomorrow and showed a colored motion picture of the Burma Road.

MICHIGAN SECTION

A symposium on postwar planning was presented at the March 31 meeting of the Section. Those taking part were Lawrence G. Lenhardt, general manager of the Detroit Department of Water Supply; Harry A. Shuptrine, bridge engineer for the Wayne County Road Commission; George R. Thompson, city engineer of Detroit; and Paul Van Buskirk, engineer for the Huron-Clinton Metropolitan Authority. Each discussed advance plans of his own particular department, and a general discussion of postwar work followed from the floor.

MOHAWK-HUDSON SECTION

On May 25 Edward T. Gawkins addressed a meeting of the Section—held at Rensselaer Polytechnic Institute in Troy, N.Y.—on the subject of "Postwar Highway Construction in New York State." Mr. Gawkins, who is assistant superintendent of operation and maintenance in the Division of Construction, New York State Department of Public Works, indicated that the New York State Postwar Planning Commission is working in coordination with national and local authorities to provide needed and justifiable public works. In addition to various building and road-repair projects, the state has a through highway program, which it is hoped will care for many of the unemployed in the transition period between war and peace.

NORTHEASTERN SECTION

The regular April meeting, held jointly with the Boston Society of Civil Engineers, was preceded by a dinner. The technical program planned for the occasion attracted widespread interest and attention, as Robert Moses, New York City Commissioner of Parks, was guest of honor and speaker. His topic was "Municipal and Metropolitan Improvements," and the first part was broadcast. The second part of his talk was of a more technical nature and elicited considerable discussion from the floor.

OKLAHOMA SECTION

On May 6 the Oklahoma Section held its second meeting of the year at Tulsa. During the afternoon session Victor H. Cochrane, Tulsa consultant, presented a paper entitled "Some Observations on Estimating Flood Control." The remainder of the evening was devoted to a report of the Committee on Postwar Construction, and to the reading of a paper by Victor Barnett on the subject, "Possibilities of New Industries in Oklahoma." Mr. Barnett is associate editor of the *Tulsa Tribune*.

PHILADELPHIA SECTION

There was a large attendance at the May meeting of the Section, which was a joint session with the Philadelphia chapter of the American Public Works Association. A symposium on city planning comprised the technical program. The participants were Edward Hopkinson, Jr., chairman of the Philadelphia City Planning Commission, who discussed the scope of the work of the Commission; John H. Neeson, Director of Public Works, whose subject was "Past Planning in Philadelphia"; Robert B. Mitchell, executive director of the City Planning Commission, who spoke on the "Future Plan of Philadelphia"; and Francis A. Pitkin, executive director of the Pennsylvania State Planning Board, whose subject was "City Planning for the Small Community." Then Thomas Buckley, chief of the Bureau of Engineering, Surveys, and Zoning, led a forum discussion of the various planning problems that have arisen.

PROVIDENCE SECTION

At the annual meeting of the Providence Section—held at the Agawam Hunt on May 16—new officers were elected for the coming year. These are Daniel O. Cargill, president; Leighton T. Bohl, vice-president; and Frederick H. Paulson, secretary-treasurer. The speaker of the evening was C. R. Horne, lieutenant commander, Civil Engineering Corps, U.S. Navy, who described his experiences while on duty with the Seabees in the Pacific area and explained the many improvised methods of construction used to save time and materials in getting the bases ready for use. The presentation of a special Navy film showing the Seabees building advance bases concluded the program.

SAN DIEGO SECTION

On April 27 members of the San Diego Section heard Charles F. Puff, engineer for Day and Zimmermann, Inc., of Philadelphia, Pa., discuss some of the engineering problems that were solved while he was chief engineer for the Philadelphia Department of Public Works. According to Mr. Puff, there has never been a boundary dispute in Philadelphia due to the fact that all questions of boundary are settled by a deputy surveyor appointed by the city and working on a salary basis. Mr. Puff's firm is now making an industrial survey in San Diego.

TACOMA SECTION

At the March dinner meeting of the Section C. R. Huick, of the Johns-Manville Sales Corporation in Seattle, presented the technicolor movie, "Unfinished Rainbows," which is the story of aluminum from its development down to the present. Later there was a general discussion on aluminum, with George C. Heikes, manager of the Tacoma plant of the Olin Corporation, answering questions on the subject. The speaker and guest of honor at the April meeting was L. W. Schatz, president of the Forest Industries Research Company of Tacoma. Mr. Schatz discussed the manufacture, properties, and uses of plastics, and pointed to the increased use of plastics that may be expected in all branches of industry after the war. His talk was highlighted by the display of many samples of plastic materials in production today. The program for the May meeting was provided by the State Department of Fisheries and the State Department of Game. Speakers were Joseph Craig and J. C. Clausen, respectively chief biologist and chief engineer for the Department of Fisheries, and R. C. Meigs, chief biologist for the Department of Game.

TENNESSEE VALLEY SECTION

The spring meeting of the Tennessee Valley Section—held at Fontana Dam, N.C., on June 10—was voted exceptionally successful. Nearly 200 members and guests of the Section from Chattanooga, Knxoville, Clinton Engineer Works, Asheville, and other points assembled early at the TVA's mammoth project on the Little Tennessee River and spent the day studying the design features of the dam and the construction methods in use. Each registrant received a brochure on the project. Construction work was in full progress, and the morning was devoted to inspection of the dam and power house. Following luncheon in the cafeteria there, the general afternoon session was called to order by Harry Wiersema, president of the Section. The group was welcomed by J. E. S. Thorpe, vice-president of the Asheville Sub-Section, which was host for the occasion; C. E. Blee, chief engineer of the TVA; and Fred Schlemmer, project manager of the Fontana Project. Various features of the dam site and of the construction work were then discussed by Portland P. Fox, Roy Keim, Oren Reed, and T. D. Lebby. The remainder of the afternoon was devoted to an inspection of the aggregate plant and the village built by TVA to house the construction forces. An informal period followed the dinner hour, and after nightfall a wonderful view of the dam and plant, under illumination for night operations, was enjoyed.

TEXAS SECTION

The Texas Section held its spring meeting in Austin on April 27. The group was welcomed to the city by the Hon. Tom Miller, mayor of Austin, and President E. N. Noyes responded for the Section. The remainder of the morning session was devoted to a discussion of the report of the Special Committee on Employment Conditions and various business matters of interest to the Section. During the luncheon that noon certificates of life membership in the Society were presented to M. C. Welborn and Thomas F. Boltz and, in absentia, to Clyde L. Huff. Following this, a program of entertainment was given by five soldiers from the 102d Infantry. Papers scheduled for the afternoon technical session were by E. W. Zimmerman, professor of resources at the University of Texas; Trigg Twichell, hydraulic engineer for the U.S. Geological Survey at Austin; and D. C. Greer, Texas State Highway Engineer. The after-dinner entertainment that evening consisted of a program of magic, given by Dr. Carl Moore, of Austin. As usual, there were an informal gathering and social hour on the Wednesday evening preceding the meeting. During the evening pupils from the Annette Duval School of Dancing entertained with a dance recital.

TOLEDO SECTION

A talk on "War Facilities and Their Influence on Postwar Plant Design" comprised the technical program at the May meeting of the Toledo Section. This was given by Joseph K. Gannett, vice-president in charge of engineering and research and eastern manager of the Austin Company. Mr. Gannett, who was in charge of the design and construction of the first windowless factory to be built, discussed the postwar outlook for the use of steel and fiberglass and the application of the "controlled-conditions" idea to this type of building, and described new techniques in concrete construction.

WYOMING SECTION

A joint meeting of the Section and the Cheyenne Engineers' Club took place in Cheyenne on April 11. Following dinner, O. B. Misz discussed surveying and construction methods used in the railroad relocation for Shasta Reservoir and the Pit River Bridge, and an enthusiastic general discussion followed his talk. Mr. Misz is an engineer with the U.S. Bureau of Reclamation.

WISCONSIN SECTION

On April 20 members of the Section and their lady guests chartered a private rapid transit car to take them to Port Washington, Wis., for a dinner meeting. John H. Kaiser, mayor of the city, welcomed the group and gave a short talk on Port Washington and its history. Later in the evening Andrew M. Houston, assistant superintendent in charge of hull construction for the Manitowoc Shipbuilding Company, gave a talk on the assembly and launching of many of the landing craft and submarines that have been built in the yards at Manitowoc. Through his contacts with officers and men from the various combat regions Mr. Houston was able to give an excellent picture of the present submarine warfare and the part that Wisconsin-made vessels are taking. His talk was illustrated with colored motion pictures made by the U.S. Navy.

ITEMS OF INTEREST

About Engineers and Engineering

Study of Community Facilities Completed by Federal Agency

Inadequate local utilities in congested production areas have caused excessive absenteeism and labor turnover, reports the Committee for Congested Production Areas. This government agency, established in May 1943, has issued a report listing the need for housing, water supply, sewage disposal, sewerage systems, streets, refuse collection and disposal. Transportation facilities and recreation provisions have also been found to be needed badly in many areas. The following excerpts have been taken from the report submitted May 10 by Corrington Gill, Director of the Committee.

"As the staff of the Committee started its work, the types of facilities needed became clear. Housing was fundamental and with the need for housing came the auxiliary facilities such as water supply, sewage disposal, sewerage systems, streets, roads, and garbage and refuse collection and disposal. Transportation was needed both to and from work and from home to shopping and recreation facilities. Schools were needed for the workers' children; child care was necessary to enable mothers to work; hospitals and physicians were needed to meet the demands of a rapidly expanded population; and recreation was essential to make these areas livable. In many areas, the demands of the war caused extreme shortages in fuel supplies and some foods. Additional restaurants, laundries, groceries, and other stores were badly needed. Local governments and service trades were losing their manpower both to the armed services and to higher-paying war industries, and replacements were extremely difficult to maintain. These were the conditions that the Committee's staff found.

"Population shifts of the defense and war periods made an up-to-date census of population necessary. Preliminary figures have been announced by the Census Bureau for three areas. The remainder will be available before June 30, 1944. Table I shows these data, together with those from the 1940 census."

Table I. Data on Population Shifts

	Population Census April 1940	Population Census March 1944	% Increase Since 1940	Population Increase Since 1940	Visitors in Addition to Population March 1944
Mobile	141,974	233,000	64%	91,000	5,000
San Diego	289,348	410,000	42%	120,000	14,000
Charleston	121,105	167,000	38%	46,000	3,000

An example of conditions encountered is to be found in the Charleston (S.C.) Area. There "the use of septic tanks for new private housing projects had resulted in insanitary conditions which prevented the use of many of these dwelling units. A Navy inspection report of these septic tanks showed that '127 of 600 were overflowing, 44 grease traps were overflowing, and 99 houses had water in the yard.' Sanitary conditions became so bad that the County Health Officer considered condemning the housing. The need for enactment of special legislation by the South Carolina legislature prevented FWA action. This act to create a special sanitary sewer district was passed in February, and District Commissioners were appointed. The Area and Washington staffs of the Committee helped FWA,

Table II. Adequacy Rating of Facilities and Services in Designated Congested Areas

The Type of Arrow Indicates Whether the Facility is Adequate, Fair, or Inadequate; the Direction of the Arrow Indicates Whether the Situation is Getting Better, Remaining About the Same, or Getting Worse

	Better	Same	Worse
Adequate	⇧	⇨	⇩
Fair	⇑	⇒	⇓
Inadequate	⬆	➡	⬇

Facility or Service	Puget Sound	Portland Vancouver	San Francisco	Los Angeles	San Diego	Detroit Willow Run	Beaumont Orange	Mobile	Key West	Charleston	Hampton Roads
Water Supply	⇧	⇨	⇒	⇨	➡	⇑	⇑	⬆	⬇	⇑	⇑
Sewers and Sewage Disposal	⇨	⇨	⇒	⇓	⇑	⇒	➡	⇑	⬇	⇑	⇑
Garbage and Refuse	⇓	⇨	⇓	⇓	⇨	⇒	➡	⇒	➡	⇒	⇒
Streets	⇨	⇑	⇒	⇓	⇑	⇨	⇒	⇑	➡	⇑	⇨
Police Equipment and Structures	⇑	⇑	⇑	⇒	⇓	⇨	⇑	⬇	⇒	⇑	⇒
Fire Equipment and Structures	⇓	➡	⇒	⇒	⇓	⇑	⇑	⇑	⇨	⇨	⇒
Housing	⇨	⇧	⬆	⬆	➡	⬆	⇑	⇑	⬇	⇨	⇨
Rents	⇨	⇒	⇒	⇑	➡	⇨	⇨	⇨	⬆	⇑	⇒
Manpower	⇓	⇒	⬇	⇒	⬇	⇒	⬇	⬇	⬇	⇒	⬇
Commercial Facilities	⇒	⇑	➡	⬇	⇑	⇨	➡	⬇	⇒	⇒	⇑
Medical Care	⇒	➡	⇓	⬆	⇑	⇑	➡	⬆	⬇	⇑	⇒
V. D. Control	⇑	⬆	⇑	➡	⇑	⇑	➡	⇒	⇨	⇨	⇑
Child Care	⇑	⇨	⇑	⬆	⇑	⇒	⇨	⇨	⬆	⇨	⇑
Education	⇑	⬆	⇑	⇑	⇑	⇑	⇑	⬆	➡	⇨	⇑
Recreation	⇑	⇑	⇒	⇑	⇑	⇑	⬆	➡	⇑	➡	⬆
Disease Control	⇒	⇑	⇨	⇨	⇒	➡	⇑	⇑	⇨	⇨	⇒
Food	⇧	⇧	⇨	⇧	⇩	⇨	⇨	⇨	⇒	⇨	⇑
Fuel	⇨	⇧	⇨	⇨	⇒	⇨	⇨	⇧	⇩	⇨	⇒
Transportation	⇒	⇨	⬆	⬆	⇓	⇒	➡	⇧	⇑	⇧	⇑
Over All Situation	⇑	⇑	⇒	⇑	⇒	⇒	⬆	⇑	⬇	⇑	⇑

FHA, and the Navy in expediting the necessary arrangements for approval. The Commissioners applied to FWA in March for the necessary funds. The project has been approved by FWA and priorities have been granted by WPB.

"The adequacy and trend of community facilities in certain designated congested areas, as rated by the Area Representatives, are shown in Table II. These ratings are based on the scores of individual projects which are in various stages of completion in each area."

N. G. Neare's Column

Conducted by

R. ROBINSON ROWE

"FOR two months," chuckled Professor Neare, "I've been hounded by engineers of our Club who assert that the May problem can be solved only by model analysis. Fearing neither wind nor wave, they volunteer to spend the rest of their lives conducting the tests in that never-never land of Knott Atoll. Since no Waves volunteered, we'll have to solve it the hard way. So, considering the premises, what number limited the fourth generation?"

"Thirty," guessed Joe Kerr. "The five couples of Sea Bees and Waves could raise the limit of three children per mother for a second generation of 15, −7 couples plus a wall-flower of irrelevant sex. These would raise 10 couples and another social outcast for the third generation, whence 30 children for the fourth. I worked out a genealogy so that none marries a relative as near as a first cousin."

"Suppose the wall-flower married a widower," ventured Ken Bridgewater, "then the answer would be $\{[(10 - 5)3 - 7]3 - 12\}\ 3 = 36$, where numbers after minuses are males by generations."

"I vote for more wall-flowers and more frequent widowerhood," said Titus Wadhouse. "Starting with 8 Waves, I get $\{[(10 - 2)3 - 2]3 - 2\}\ 3 = 192$. In a race of Amazons, the Mosaic Code has no place. The Professor implied it but didn't say it—out of malice, I suspect."

"My answer is $\{[(10 - 4)3 - 4]3 - 2\}\ 3 = 120$," countered Cal Klater, "agreeing with the lemma of frequent widowerhood but permitting no marriages of kin as near as first cousins."

"Which is exactly right," agreed the Professor, "even if you don't know why. The why is the common law, which follows all civilized peoples in one form or another. Our common law avoids a marriage of kin nearer than first cousins. Many states add statutory law to void marriage of first cousins, as did the Knottatollish. When done, common law extends the ban to half-cousins by holding those of the half blood to the rule for the full blood. On Knott Atoll, no couple could have even one common grandparent. Can you brief the genealogy, Cal?"

"It's simple, Noah. Sea Bees A, B, C, and D each married and each begat one son, respectively A', B', C', and D'. A' married the daughters of B, and begat one son A''. B' married the daughters of A and had no son. Similarly for C' and D', there being one son C'' who married the daughters of A' and B', and vice versa. Simple as *ACB!*"

"And very, very proper. Now I want to tell you about two Army engineers that just discovered an old castle in Normandy—so old that it may have been Rollo's. A boudoir interested them because there was a mirror at the middle of each of the four equal walls and two bronze plaques set 10 ft apart in the floor. Curious, Ned stepped on one plaque and Dick on the other, when lo, each beheld half-size reflections of the other in each of the four mirrors. How large was the boudoir?"

[*Nearest solution came from Anne Othernut (J. Charles Rathbun) who calculated 114 from Cal's premises, but who preferred the less prudish 192. Walter R. Shilts quipped, "zero, for lack of a parson." Many preferred polygamy to widowering, with no difference in answer. Correct mail-delayed solutions to the April problem (Eniwetok parade ground) came from Anne Othernut, Col. Albert B. Jones, and F. H. Constant.*]

Armed Services Welcome Inventions

Those bright ideas that you have had are encouraged by the National Inventors Council of the Department of Commerce. Especially is this true if the brain child will solve one of the problems encountered by our armed services. A list of such teasers which may stir the imagination of civil engineers is here given. Any solution should be sent to the National Inventors Council, Washington 25, D.C.

A relatively simple gage to measure the impulse of explosion blast, positive and negative phases to be determined separately but concurrently. It would be desirable if the duration of each phase could be determined in some simple manner.

A light detachable rock-drill bit-grinder for re-sharpening detachable bits. Capacity approximately 20 bits per hour and weight 200 to 250 lb.

Means of controlling fires in fighting tanks for a sufficient period of time to evacuate personnel. The process should not be injurious to personnel and should be manually controlled and operated.

Waterproof compound for treating duck used in fabricating canvas drinking-water storage tanks.

A means for unloading ships by use of a quickly erected tramway.

The use of anti-stripping agents with cutback asphalts to permit effective coating of wet aggregates.

Additional methods for the chemical stabilization of soil.

A means for removing asphalt from drums and melting to pumpable temperature on a quantity-production basis.

A quick and effective non-bituminous dust palliative for all climates.

Device to maintain or indicate, within 5 ft, the relation of an aerial camera to the vertical.

Reduction of glare from glass surfaces by durable coatings suitable for field application.

Optical method for determining the dif ference between an artificial green and natural green.

Destruction and removal of obstacles t landing operations. Obstacles may b visible or concealed and may be off or o shore.

Short-base, wide-angle range-finde readily portable and capable of bein mounted on a vehicle.

Location and destruction of conceale enemy emplacements, pillboxes, and similar strong points.

Methods for protecting our vehicle from the effects of enemy land mines.

Improvements in tank vision device and control instruments. There is specia interest in reducing space requirements an improving performance of gyroscopic compasses.

Ingenious and simple decoy devices fo confusing and misleading enemy.

Technical data as to strategic enemy targets such as chemical plants, explosive plants, power plants.

A voice-transmitting gas mask which would permit the wearer's voice to b heard with clarity.

Clothing giving protection against falling pieces of white phosphorous.

Colored smokes using readily available pigments for obtaining the desired color.

Protective ointments to counteract vesicants.

Methods of generating stable artificia fogs, and methods of dispersing artificia and natural fogs.

Protection against flame throwers.

Odorless toxic agents.

Design of a life vest which automatically inflates and turns a man on his back whe he is thrown overboard by concussion an is unconscious.

Noiseless hand generator combined with a light-weight flashlight. The generator should be pumped at the rate of 40 rpm, and the light should be continuously brilliant and start on the first pump.

Plumb-bob type of generator to operate a light 6-volt radio; generator probably operated by a reel winding up and letting out the plumb-bob.

Methods of insuring CO_2 inflation of life rafts within 30 sec at a temperature of 20 F to 40 F.

Directory of College Research

JUST published by the Engineering College Research Association Council is a "Directory of Member Institutions and Their Principal Fields of Research." Altogether 67 colleges and universities are listed, and for each is given the name of the engineering research division, the director and other officers, and the principal field or fields in which the institution is particularly well equipped. Also given, where pertinent, are special facilities. The bound, paper covered volume of 77 pages also includes an alphabetical index of the research officers, and an alphabetical index of research fields.

For information regarding the directory, address Miss Ruth A. White, Acting Secretary, Engineering College Research Association, Austin 12, Tex.

NEWS OF ENGINEERS

Personal Items About Society Members

AUSTIN B. SMITH has been promoted from the rank of captain in the Corps of Engineers, U.S. Army, to that of major. He is chief of the dredging and navigation section of the Mississippi River Commission, at Vicksburg, Miss.

WILLIAM W. WANAMAKER, colonel, Corps of Engineers, U.S. Army, has been relieved of duty as district engineer at Denison, Tex., and assigned to foreign service.

L. D. WORSHAM, brigadier general, Corps of Engineers, U.S. Army, was recently appointed Assistant Chief of Engineers in charge of troops, with headquarters in Washington, D.C. General Worsham was previously stationed at Edmonton, Alberta, where he supervised the construction of the Alaska Highway and the Canol Oil Project.

J. J. DOLAND, professor of civil engineering at the University of Illinois and supervising engineer for the University of Illinois Airport at Urbana, Ill., has been awarded the honorary degree of doctor of science by St. John's University at Collegeville, Minn. The presentation took place at the commencement exercises held on June 2.

GARNER W. MILLER is now a colonel in the Corps of Engineers, U.S. Army, the rank representing a promotion from that of lieutenant colonel. Colonel Miller has been district engineer in the U.S. Engineer Office at Memphis, Tenn., since September 1943.

A. JOHN EVELAND, mining geologist and engineer, announces that he has changed his headquarters from the Russ Building in San Francisco to Mexico City, where his address will be the American Club, Apartado 15—Bis, Mexico D.F., Mexico.

THOMAS H. EVANS, who is on military leave from the department of engineering at the University of Virginia, was recently promoted from the rank of major in the Corps of Engineers, U.S. Army, to that of lieutenant colonel. Colonel Evans is stationed in Washington, D.C., where he is executive officer for the Operations Branch of the Office of the Director of Military Training, Army Service Forces.

B. A. POOLE, major, Sanitary Corps, U.S. Army, has been transferred from the position of regional sanitary engineer of the Sixth Service Command, with headquarters in Chicago, to the Office of the Chief of Engineers, Repairs and Utilities Branch, in Washington, D.C. In this new capacity Major Poole will supervise all the water and sewerage plants operated by the Army in the continental limits of the United States. He will be succeeded as regional sanitary engineer at Chicago by **CAPT. PAUL W. REED**, who is being transferred from Camp McCoy, Wis., where he was sanitary engineer.

THEODORE B. APPEL, JR., has accepted the position of chief engineer for the C. S. Johnson Company at Champaign, Ill. Until lately he was engaged on war construction for the Arundel Corporation in Puerto Rico.

JAMES NORMAN PEASE, colonel, Corps of Engineers, U.S. Army, is now in the Pacific area. Colonel Pease formed the 369th Special Service Engineer Regiment, which he commands.

A. S. HATCH, superintendent of the Houston (Tex.) Water Division, has been appointed supervisor of the city's new five-million-dollar water supply improvement.

GEORGE S. BROCKWAY has been granted a leave of absence from his duties as city engineer of West Palm Beach, Fla., in order to accept a commission as commander in the Civil Engineering Corps of the U.S. Naval Reserve.

J. E. ROOT recently retired as director of public works for Cincinnati, Ohio, after serving in that capacity since 1931.

ALVIN M. MARTIN, formerly designer for the Consolidated Vultee Aircraft Corporation at Fort Worth, Tex., is now architectural bridge draftsman for the Texas State Highway Department.

LEWIS PENNOCK has returned to his post as junior design engineer in the bridge department of the Texas State Highway Department at Austin, after a year's leave of absence, during which he served as associate engineer in the U.S. Engineer Office at Fort Sam Houston, Tex.

WILLIAM HENRY SMITH is now assistant director of public works for Kansas City, Mo.

DONALD D. LEAMAN, until lately junior engineer in the U.S. Engineer Department at Milwaukee, Wis., was recently commissioned an ensign in the U.S. Navy.

WALTER M. SMITH, consulting engineer for the Illinois State Division of Waterways, has been elected a director of the Metropolitan Water Company of Chicago, which was formed to furnish Lake Michigan water to a number of towns in the Chicago area.

BENJAMIN F. RUSH has been released from active duty in the U.S. Navy (he held the rank of commander in the Civil Engineering Corps) in order to serve as superintendent of public works for the Territory of Hawaii.

CARROLL L. MANN, JR., was recently promoted from the rank of major in the Corps of Engineers, U.S. Army, to that of lieutenant colonel. Colonel Mann is post engineer at Fort Bragg, N.C.

L. F. HARZA is at present in Montevideo, Uruguay, where he went to take charge of engineering for the completion of the Rio Negro hydroelectric project. Mr. Harza is president of the Harza Engineering Company in Chicago.

FREDERICK LIENHARD has announced the opening of consulting engineering offices at 99 Wall Street, New York 5, N.Y. Mr. Lienhard, who was formerly associated with the late **LEON S. MOISSEIFF**, will specialize in bridges, structures, and metals.

WILLIAM D. DARBY, consulting engineer of Milwaukee, Wis., was recently appointed chief of the division of manpower utilization in the Wisconsin War Manpower Commission.

TRAVIS L. SMITH III, captain, Corps of Engineers, U.S. Army, is now in China, where he is serving as district engineer for the Corps on road construction. Prior to entering the service, Mr. Smith was roads and drainage engineer for Lockwood, Andrews and D. M. Duller, of Houston, Tex.

JAMES M. YORK has been promoted from the rank of first lieutenant in the Corps of Engineers, U.S. Army, to that of captain.

THOMAS M. ROBINS, major general, Corps of Engineers, U.S. Army, and **GLENN L. PARKER** have been appointed members of the International Columbia River Engineering Board (created by the International Joint Commission) to investigate and report on the development of the Columbia River Drainage Basin. General Robins is Assistant Chief of Engineers, while Mr. Parker is chief hydraulic engineer for the U.S. Geological Survey.

HERBERT B. FOSTER, JR., of Plymouth, Calif., is now in New Guinea, where he is fighting malaria for the Sanitary Corps of the U.S. Army. He has the rank of captain.

LLEWELLYN EVANS, after two years as consultant to the War Production Board in Washington, D.C., has returned to his office in the Power Building in Chattanooga, Tenn.

GEORGE P. PALO, formerly principal civil engineer for the Tennessee Valley Authority at Knoxville, Tenn., was recently commissioned a lieutenant (jg) in the Civil Engineering Corps of the U.S. Naval Reserve and, at present, is stationed in Washington, D.C.

RALPH B. WILEY has been made head of the newly created School of Civil Engineering and Engineering Mechanics at Purdue University. This school represents a recent merger of the department of applied mechanics with the civil engineering school. Professor Wiley was previously head of the civil engineering school at the university.

DECEASED

JAMES WALLACE BEARDSLEY (M. '01) retired consultant of Syracuse, N.Y., died at Auburn, N. Y., on May 15, 1944, at the age of 83. Early in his career (1892 to 1898) Mr. Beardsley was assistant engineer for the Chicago Sanitary District, and from 1898 to 1902 with the U.S. Corps of Engineers. He then served as consulting engineer to the Philippine Commission and as Director of Public Works for the Philippines. From 1910 to 1916 he was chief engineer for the Puerto Rico Irrigation Service, and later was assistant chief engineer for the Grand Canal Improvement Board in China, member of the Panama Highway Commission, and consulting engineer on harbors to the Dominican Republic. From 1930 until his recent retirement Mr. Beardsley maintained a consulting practice in Syracuse.

CLARENCE MOORE BLAIR (M. '17) president and treasurer of Clarence M. Blair, Inc., of New Haven, Conn., died at a hospital in that city on May 21, 1944.

CLARENCE M. BLAIR

He was 58. A native of New Haven, Mr. Blair had been in engineering practice there all his life. After his graduation from Sheffield Scientific School in 1904, he became connected with Albert B. Hill in a consulting capacity, remaining there until 1930. From 1930 to 1938 he was president and treasurer of Blair and Marchant, Inc., and from the latter year on he was president and treasurer of Clarence M. Blair, Inc. A specialist in water supply, Mr. Blair was engineer in charge of the construction of several large Connecticut dams, tunnels, and pipe lines. He served as Director of the Society from 1940 to 1942, and he was former president of the Connecticut Society of Civil Engineers.

JOHN FRANCIS COLEMAN (M. '01) Past-President and Honorary Member of the Society, died on June 3, 1944, in New Orleans, La., where he had for many years maintained a consulting practice. He was 77. A brief biography and photograph of Mr. Coleman appear in the "Society Affairs" department of this issue.

LUIS AUGUSTIN DELIZ (Assoc. M. '30) civil engineer of San Juan, Puerto Rico, died there on February 17, 1944. Mr. Deliz, who was 53, was a native of Puerto Rico, but received his education in this country. From 1911 to 1917 and, again, from 1918 to 1920, he was assistant engineer in the Puerto Rico Department of the Interior; from 1920 to 1926, assistant engineer for the American Railroad Company of Puerto Rico; and from 1926 to 1929, superintendent of the San Juan Public Works. Later he was with the New York City Board of Transportation, and from 1933 until recently was assistant chief of the Bureau of Translations, Insular Capitol, San Juan.

HERMAN FRANCOIS DOELEMAN (M. '17) consulting engineer of Baltimore, Md., died in a hospital there on May 30, 1944, at the age of 69. Born and educated in Holland, Mr. Doeleman came to the United States in 1893. From 1904 to 1912 he was designing engineer for the American Bridge Company in Baltimore, and in 1912 and 1913 chief engineer for the Baltimore plant of the Carnegie Steel Company. Except for two years as lieutenant colonel in the Corps of Engineers, U.S. Army, during the first World War, he maintained a consulting practice in Baltimore, specializing in building design. Mr. Doeleman was, also, president of Belts Wharf Warehouse, Inc.

FREDERIC HAROLD FAY (M. '04) consulting engineer of Boston, Mass., died in a hospital in that city on June 5, 1944. Mr. Fay, who was 71, began his career as a draftsman for the Boston Bridge Works in 1895, later becoming engineer in charge of the bridge and ferry division. He resigned from city service in 1914 in order to form an engineering firm with Prof. Charles M. Spofford and Sturgis H. Thorndike. He had served as consultant on many projects here and abroad and as engineer to the War Department, during the first World War, on the design and supervision of the Boston Army Supply Base. An authority on city planning, he had been chairman of the Boston City Planning Board and of the Boston Board of Zoning Adjustment, and a member of the Massachusetts State Planning Board. He served as Director of the Society in 1917 and 1918.

LOUIS FOCHT (Assoc. M. '92) chief engineer of the division of engineering and railroad taxes of the New Jersey State Tax Department and superintendent of the Delaware River Joint Toll Bridge Commission, died in Trenton, N.J., on June 4, 1944. He was 80. Mr. Focht's earliest work was in the engineering department of the Lehigh Valley Railroad and, at one time, he was engaged in railroad work in Colombia and Venezuela. From 1898 on he was with the New Jersey state government.

JOHN BLAKE GORDON (M. '13) director of sanitary engineering for the District of Columbia, died in Washington, D.C., on May 9, 1944. Mr. Gordon, who was 64, began his engineering career with the Engineer Department of the District of Columbia, but from 1905 to 1910 was in private practice. From the latter year to 1921 he was assistant superintendent in the Sewer Division, Engineer Department of the District of Columbia; from 1921 to 1932, sanitary engineer for the District of Columbia; and since 1932 director of sanitary engineering for the District.

LYMAN GRISWOLD (M. '21) consulting civil engineer of Portland, Ore., died on May 10, 1944, at the age of 64. Mr. Griswold's early career was spent with the Oregon Land and Water Company at Irrigon and as construction engineer for several railroad companies. From 1913 to 1915 he was assistant state highway engineer in the Oregon State Highway Department, and during the first World War served overseas in the Corps of Engineers, having the rank of major. Returning to Portland in 1919, Mr. Griswold opened engineering offices there, and continued in general practice until his death.

WILLIAM CUSHING HAMMATT (M. '0 consulting engineer of Los Angeles, Cali died in that city on March 30, 1944. Hi age was 71. Mr. Hammatt had been co struction engineer for the Chicago an Northwestern Railway and the Mexica Central Railway, and superintendent o construction for the American Smeltin and Refining Company. From 1912 t 1934 he maintained a consulting practic in Los Angeles, and from 1934 to 1940 wa an engineer for the PWA. He then re sumed his consulting practice.

MAXWELL HENRY (Assoc. M. '32) assistant professor of electrical engineerin at the College of the City of New York, died suddenly at his home in New York City on April 7, 1944. Professor Henry, who was 47, had been in the engineering department of the College of the City of New York, his alma mater, since his graduation in 1920. He laid out the hydraulic laboratory there and assisted in the construction of Brooklyn and Hunter College buildings.

HENRY LAWRENCE HOWE (M. '28) city engineer of Rochester, N.Y., died on May 31, 1944, at the age of 56. Mr. Howe spent much of his career in the Engineering Department of the City of Rochester—he was assistant engineer on sewage disposal from 1914 to 1917; director of the municipal testing laboratory from 1919 to 1928; and city engineer and deputy commissioner of public works from 1928 to 1932 and, again, from 1938 until his death. He was the inventor of asphalt pavement sampling and testing apparatus. During the first World War he served in the Navy and, until recently, held the rank of lieutenant commander in the reserve.

LEIGH ANSON HUNT (Assoc. M. '07) retired engineer of Brownsville, Tex., died suddenly in San Antonio, Tex., on May 7, 1944. Mr. Hunt, who was 70, was an authority on the use of cement. In 1898 he built the plant of the Wolverine Cement Company at Coldwater, Mich., and later was called upon to construct plants throughout the United States, Canada, Mexico, and Alaska. His inventions covered all types of cement-manufacturing machinery. During the first World War he served overseas with the 35th Division, attaining the rank of colonel. At the end of the war he organized the Hunt Engineering Company, of Kansas City. He retired from active practice in 1929 and had lived in Brownsville, Tex., most of the time since.

HENRY WRIGHT HURLEY (Jun. '40) lieutenant colonel, Corps of Engineers, U.S. Army, is a recent casualty of the war. He was 32. A graduate of the University of Tennessee in 1934, Colonel Hurley had been with the U.S. Forest Service and the U.S. Bureau of Public Lands. In July 1936 he entered the Corps of Engineers, U.S. Army, with the rank of lieutenant. He was in the 17th Armored Engineer Battalion and, before going overseas, had been stationed at Fort Benning, Ga., and Fort Bragg, N.C.

ALBERT ELLIOTT KIMBERLY (M. '27) principal assistant engineer for the Ohio State Department of Health, Columbus.